USDA

United States Department of Agriculture

Natural Resources Conservation Service and Forest Service

In cooperation with Michigan Department of Agriculture, Michigan Agricultural Experiment Station, Michigan State University Extension, and Michigan Technological University

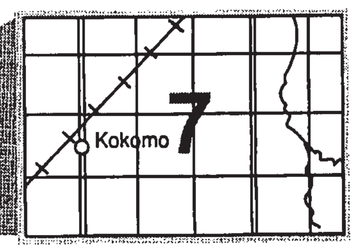
Soil Survey of Alcona County, Michigan

How to Use This Soil Survey

General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

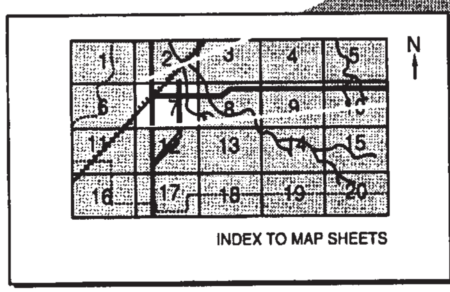
To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.



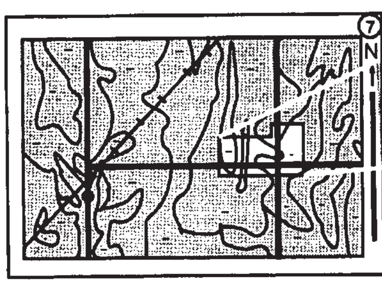
MAP SHEET

Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

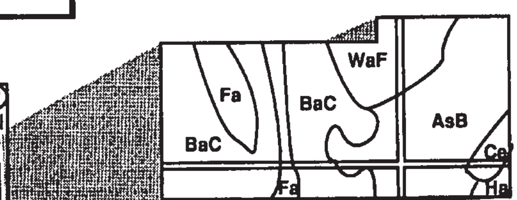


To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet and turn to that sheet.



MAP SHEET

Locate your area of interest on the map sheet. Note the map units symbols that are in that area. Turn to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1991. Soil names and descriptions were approved in 1992. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. This survey was made cooperatively by the Natural Resources Conservation Service, the Forest Service, Michigan Department of Agriculture, Michigan Agricultural Experiment Station, Michigan State University Extension, and Michigan Technological University. Financial assistance was provided by the Alcona County Board of Commissioners. The survey is part of the technical assistance furnished to the Alcona County Soil and Water Conservation District.

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

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Cover: Deer grazing in a wildlife planting in an area of Chinwhisker sand, 0 to 4 percent slopes.

Contents

Issued 1998

Foreword

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

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

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

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

Jane E. Hardisty
State Conservationist
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Soil Survey of
Alcona County, Michigan

By Thomas E. Williams, Michigan Department of Agriculture

Fieldwork by Thomas E. Williams and Larry F. Perrault, Michigan Department of Agriculture; Dwight S. Jerome and Ramez Mahjoory, Natural Resources Conservation Service; and Jeffrey Bruggink, Richard Watson, and Peter Greaney, Forest Service

United States Department of Agriculture, Natural Resources Conservation Service
and Forest Service,
in cooperation with
the Michigan Department of Agriculture, Michigan Agricultural Experiment Station,
Michigan State University Extension, and Michigan Technological University

ALCONA COUNTY is in the northeastern part of the Lower Peninsula of Michigan (fig. 1). It is adjacent to Lake Huron. The county is bordered on the north by Alpena County, on the west by Oscoda County, and on the south by Iosco County. The county has an area of 445,126 acres, or approximately 695 square miles. About 70 percent is forested, including 113,000 acres in the Huron National Forest. About 13 percent of the county is farmed, and about 17 percent is used for other purposes, including recreation, wetlands, and transportation. In 1990, the population of the county was 10,145 and that of Harrisville, the county seat, was 559. Timber production, farming, and tourism are the main enterprises in the county.

Alcona County has about 153 different soil types. The soils vary widely in texture, natural drainage, slope, and other characteristics. Well drained and moderately well drained soils make up about 68 percent of the county, somewhat poorly drained soils make up 20 percent, and poorly drained and very poorly drained soils make up 12 percent.

General Nature of the County

This section provides general information about the county. It describes history and development, climate, physiography, and lakes and streams.

History and Development

Alcona County was formed by the Michigan Legislature in 1840 (Gauthier, 1989). It was first known as the Negwegon District, named after the Chippewa Indian chief. In 1843, the name was changed to Alcona District. Alcona is a Chippewa word meaning "a fine plain." In 1846, the first settlement in the county, a commercial fishing port, was established at the village of Springport. The first crop, rye, was raised near Springport in 1857. Additional ports were established at Alcona, Black River, and Harrisville to accommodate the growing fishing fleets and to serve the lumber industry. The Sturgeon Point Lighthouse opened in 1870 as a navigation aid, and the Life Saving Station opened in 1876.

In 1856, a water-powered sawmill was sold to Benjamin Harris. The mill was located at Mill Pond and was developed into a grist mill and sawmill. The village at this mill, Harrisville, became the county seat when Alcona County was established in 1869. By 1875, the expansion of logging had opened the county westward to Curran. The largest sawmill was at Black River. This mill burned in 1898.

Today the commercial ports no longer serve lumber and fishing commerce. The last commercial

Figure 1.—Location of Alcona County in Michigan.

fishing operation in Black River closed in 1950. The highway and road system serves the transportation needs of the forest producer, farmer, and tourist.

Climate

The climate in the county is highly varied because of topographic variations and the county's proximity to Lake Huron. These variations cause changes in the climate over distances of only a few miles. Since adequate records are not available in Alcona County, data from stations at East Tawas and Hale, in adjacent Iosco County, were used.

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

In winter, the average temperature is 22.4 degrees F at East Tawas and 20.1 degrees at Hale. The average daily minimum temperature is 13.5 degrees F at East Tawas and 10.5 degrees at Hale. The lowest temperature on record, which occurred at East Tawas on February 20, 1929, is -29 degrees. In summer, the average temperature is 65.8 degrees F at East Tawas and 65.5 degrees at Hale. The average daily maximum temperature is 77.7 degrees F at East Tawas and 78.2 degrees at Hale. The highest recorded temperature, which occurred at East Tawas on July 9, 1936, is 106 degrees.

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

The total annual precipitation is 29.46 inches in East Tawas and 28.05 inches in Hale. Of this, about 60 percent usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 15.02 inches. The heaviest one-day rainfall during the period of record is 3.72 inches at East Tawas on August 16, 1938, and 3.50 inches at Hale on September 21, 1947. Thunderstorms occur on about 32 days each year, and most occur in July.

The average seasonal snowfall is 49.5 inches at East Tawas and 50.8 inches at Hale. The greatest snow depth at any one time during the period of record was 37 inches. On the average, 93 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

Based on data recorded at the National Weather Service Office at Alpena Airport, in adjacent Alpena County, the average relative humidity at 1:00 p.m. is about 61 percent. Humidity is higher at night, and the average at 7:00 a.m. is about 83 percent. The sun shines 64 percent of the time possible in summer and 37 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 9.2 miles per hour, in April.

Physiography

Alcona County is in the northeast upland division of the state, which is covered by thick deposits of glacial drift. Major topographic divisions are level and undulating plains and rolling to hilly morainic areas (fig. 2). Five distinct kinds of surface features occur in Alcona County. These are moraines, till plains, glacial drainage terraces, lake plains, and deltas. All of these features formed as a result of the complex action of glaciers and postglacial lakes (Kelley and Farrand, 1988).

The morainic areas are characterized by rolling to steep, uneven, knoblike hills and pothole depressions. The largest morainic area extends from

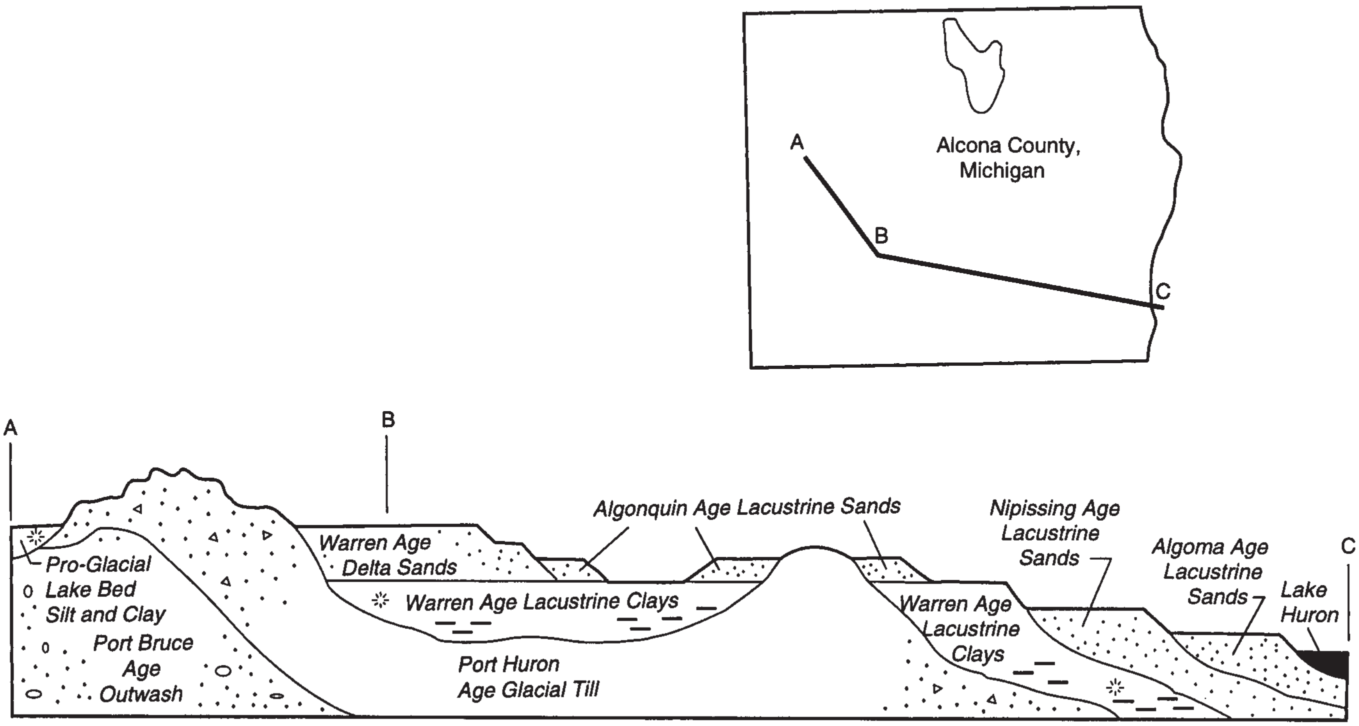

Figure 2.—Diagrammatic cross-section showing glacial deposits of Alcona County. Modified after Burgis and Eschman, 1981.

central Mitchell Township through the eastern part of Curtis Township.

The till plains, which occur in the form of drumlin fields, are characterized by elongated hills and ridges oriented from north to south. These till plains occur in Alcona, Hawes, and Haynes Townships.

Glacial drainage terraces are intermingled with the morainic areas and till plains. These terraces are characterized by elongated, nearly level to sloping areas that are pitted in places. The largest glacial drainage terrace is in the Au Sable River valley in the western part of Curtis Township.

The lake plains are associated with the former Great Lakes Warren, Algonquin, and Nipissing. They are characterized by nearly level to undulating areas separated by steep scarps, reflecting changes in lake elevation. The largest lake plain is in Mikado Township.

The deltas are characterized by broad, nearly level plains dissected at widely spaced intervals by deeply incised stream and river channels. The largest delta in the county formed at the outlet of the Au Sable River when it flowed into glacial Lake Warren.

The highest elevation in the county, 1,273 feet above mean sea level, is 3 miles southwest of Curran. The lowest elevation, 577 feet above mean sea level, is at the shoreline of Lake Huron, which forms the eastern boundary of Alcona County. Other significant elevations are the ancient shorelines of Great Lakes Warren, Algonquin, and Nipissing, which are about 850 feet, 680 feet, and 600 feet, respectively.

Lakes and Streams

Alcona County has about 60 lakes and 3 major rivers. These water areas differ in size, shape, and shoreline characteristics. Bodies of water more than 40 acres in size make up about 10,500 acres in the survey area.

Among the larger lakes are Hubbard Lake, 8,821 acres; Alcona Dam Pond, 1,096 acres; Cedar Lake, 780 acres; and Jewell Lake, 185 acres.

Alcona County includes five watersheds. The Au Sable River flows south through the southwest corner of the county and drains the Au Sable River Watershed. The Pine River and its tributaries drain the Pine River Watershed in the south-central part of the county. The Pine River flows to the southeast and leaves the county in Mikado Township. The Black River drains the Black River Watershed in the northeastern part of the county and flows into Lake

Huron at the village of Black River. Wolf Creek drains the Wolf Creek Watershed in the northwestern part of the county. Hubbard Lake receives water from feeder streams in the Hubbard Lake Watershed in the north-central part of the county. Hubbard Lake drains to the Lower South Branch of the Thunder Bay River.

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

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

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

Survey Procedures

The general procedures followed in making this survey are described in the National Soil Survey Handbook of the Natural Resources Conservation Service (USDA/NRCS). The Huron-Manistee National Forest Ecological Classification System (Driscoll and others, 1984) was used in conjunction with the handbook to prepare the soil survey on the Forest Service lands within the administrative boundary of the Huron National Forest. The map units on the Forest Service lands were designed differently from those in other parts of the survey area.

The ecological classification system is an integrated system that includes evaluation and classification of landscape areas. Ecological units are mapped on aerial photographs, and interpretations are made from inventory maps for use in managing forest land and resources. In this survey, map symbols 209B through 282 identify map units within the Huron National Forest.

Procedures for Map Units 11B to 111B

The soil survey maps made for conservation planning prior to the start of the project were among the references used. Before the actual fieldwork began, preliminary boundaries of slopes and landforms were plotted stereoscopically on 1:20,000 leaf-off aerial photographs. USGS topographic maps at a scale of 1:24,000 were used to help the soil scientists relate land and image features.

A reconnaissance was made by pickup truck before the soil scientists traversed the surface on foot. In areas where the soil pattern is very complex, traverses and random observations were spaced as closely as 200 yards. In areas where the soil pattern is relatively simple, traverses were about one-fourth mile apart.

As they traversed the surface, the soil scientists divided the landscape into segments. For example, a hillside was separated from a swale and a gently sloping ridgetop from a very steep side slope.

Observations of such items as landforms, blown-down trees, vegetation, and roadbanks were made without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations of the landscape and vegetation, and photo interpretation. The soil material was examined with the aid of a hand auger or a spade to a depth of about 7 feet. The pedons described as typical were observed and studied in pits that were dug with shovels, mattocks, and digging bars.

Notes were taken on the composition of map units during the first years of the project. These notes were supplemented with additional notes as mapping progressed and as the composition of individual map units was determined.

Samples for chemical and physical analyses were taken from representative sites of some soils in the survey area (USDA, 1991). The analyses were made by the Soil Research Laboratory, Michigan Technological University, Houghton, Michigan, and the National Soil Survey Laboratory, Lincoln, Nebraska. The results of the studies can be obtained on request from the two laboratories or from the State office of the Natural Resources Conservation Service in East Lansing, Michigan.

After the completion of soil mapping on aerial photographs, map unit delineations were transferred by hand to another set of the same photographs. Cultural features were recorded from observations of the maps and the landscape.

Procedures for Map Units 209B to 282

Before ecological units were mapped, information on the climate, geology, soils, hydrology, and vegetation in the survey area was collected. Research techniques were used in mid and late successional stands to collect information on vegetative and soil components in areas of uplands. Samples were not collected on early successional aspen stands, young stands, plantations, or stands disturbed by recent harvest or fires. The results were used in developing ecological map units that are defined on the basis of both abiotic and biotic landscape characteristics. Abiotic landscape characteristics are generally stable over time, such as climate and landforms. Biotic characteristics are generally unstable over time, such as vegetation.

A premapping reconnaissance was conducted in the survey area before actual field inventory began. Important results of the reconnaissance activities include a listing of the expected ecological units that would be mapped in the area, the definition of features differentiating the units, and a set of specific sites in the Huron-Manistee National Forest where detailed data had been collected and analyzed in the laboratory for quality control.

Following reconnaissance, the mapping personnel traversed the landscape, evaluated the components of the current ecosystems, determined and observed ecological unit boundaries in the field, and delineated preliminary map units on aerial photographs. During field mapping, stereo images, photo-tones, and photo colors were used to delineate landscape features on the aerial photographs. Some important characteristics used by the field personnel to evaluate the context of an area included water table levels, soil texture and color, drainage systems, geologic indicators, and interpretation of vegetative species groups.

Mappers typically inventoried 300 to 500 acres per day. They performed detailed evaluations and completed note cards on 10 to 15 specific sites. These sites were strategically selected for the examination of landscape features and the collection of data on overstory, understory, ground flora, forest floor, soil, substratum, and ground water for documenting ecological units. Profiles of sandy soils were described to a depth of 15 feet. The presence of textural bands has been shown to have a significant influence on tree growth and species composition (Hannah and Zahner, 1970; Host and others, 1988). Thus, recording the presence, absence, or intensity of deep-lying textural bands was an important part of the sampling and inventory scheme. These data are a permanent part of the forest records available at the Huron-Manistee National Forest supervisor's office.

Following field inventory, the final boundaries of the ecological units were drawn on the aerial photographs. The completed photography was checked for line closure and for matching of delineations across photographs.

General Soil Map Units

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

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

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

Nearly Level and Gently Undulating Soils That Are Very Poorly Drained and Somewhat Poorly Drained

Most areas of these soils are used as woodland. Some are used for building site development. The soils are suited to trees and to habitat for wetland wildlife. They are poorly suited or unsuited to crops. The major management concerns affecting woodland are the equipment limitation and the windthrow hazard. If cultivated crops are grown, removing excess water, preventing ponding, and providing drainage outlets are management concerns. The soils are poorly suited or unsuited to building site development and to septic tank absorption fields.

1. Au Gres-Wakeley-Tawas Association

Deep, nearly level and gently undulating, somewhat poorly drained and very poorly drained, sandy and mucky soils that formed in sandy material or in organic material underlain by sandy or sandy and clayey material; on lake terraces

The Au Gres soils in this association are on long narrow ridges. The Wakeley and Tawas soils are in long narrow depressions. Slopes range from 0 to 4 percent.

This association makes up about 14 percent of the county. It is about 35 percent Au Gres soils, 25 percent Wakeley soils, 15 percent Tawas soils, and 25 percent soils of minor extent.

Au Gres soils are gently undulating and are somewhat poorly drained. Typically, the surface layer is black sand about 3 inches thick. The subsurface layer is pinkish gray sand about 7 inches thick. The subsoil is sand about 23 inches thick. It is mottled. The upper part is dark brown, the next part is dark yellowish brown, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is pale brown, mottled sand. In some areas the substratum is reddish brown, mottled silty clay below a depth of 40 inches.

Wakeley soils are nearly level and are very poorly drained. Typically, the surface layer is black, mottled mucky sand about 6 inches thick. The sandy part of the substratum is about 23 inches thick. The upper part is gray sand; the next part is grayish brown, mottled sand; and the lower part is grayish brown, mottled, stratified sand and loamy sand. The clayey part of the substratum extends to a depth of about 60 inches. It is pinkish gray, mottled clay in the upper part and pinkish gray, mottled, stratified clay and silty clay in the lower part.

Tawas soils are nearly level and are very poorly drained. Typically, the surface layer is black muck about 5 inches thick. The next layer also is black muck. It is about 12 inches thick. The substratum to a depth of about 60 inches is brown and dark brown sand.

Of minor extent in this association are the moderately well drained Croswell soils, the somewhat poorly drained Allendale soils, and the very poorly drained Ausable soils. Croswell soils are on the higher and broader ridges. Allendale soils are underlain by silty clay. They are on low ridges. Ausable soils are on flood plains.

This association is used mainly as woodland or as wildlife habitat. Some areas of the Au Gres soils are used for building site development. If the soils are used as woodland, the major management concerns are equipment limitations, the windthrow hazard, and plant competition. Seedling mortality is an additional concern on the Wakeley and Tawas soils. The soils in this association are poorly suited to use as cropland or as building sites. Ground-water pollution is a hazard.

2. Lupton-Tawas-Leafriver Association

Nearly level, very poorly drained, mucky soils that formed in organic material or organic material and sandy material; on lake plains and outwash plains

The soils in this association are in depressional areas. Slopes range from 0 to 2 percent.

This association makes up about 6 percent of the county. It is about 40 percent Lupton soils, 25 percent Tawas soils, 15 percent Leafriver soils, and 20 percent soils of minor extent.

Typically, the surface layer of the Lupton soils is black muck about 5 inches thick. The underlying layers to a depth of about 60 inches are dark reddish brown muck.

Typically, the surface layer of the Tawas soils is black muck about 5 inches thick. The next layer also is black muck. It is about 12 inches thick. The substratum to a depth of about 60 inches is brown and dark brown sand.

Typically, the surface layer of the Leafriver soils is black muck about 9 inches thick. The subsoil is brown, mottled sand about 12 inches thick. The substratum extends to a depth of about 60 inches. It is grayish brown, mottled sand in the upper part and dark grayish brown sand in the lower part.

The most common soils of minor extent in this association are the ponded Aquents and Histosols and the very poorly drained Dorval soils and Borosaprists.

This association is used as wildlife habitat or as woodland. The main management concerns are the windthrow hazard, equipment limitations, seedling mortality, and plant competition.

This association is generally unsuited to crops and pasture because of wetness and low strength. The soils are generally unsuited to building site development because of ponding and low strength.

Nearly Level to Rolling Soils That Are Well Drained to Poorly Drained

Most areas of these soils are used as cropland or pasture. Some are used as woodland or for building site development. The soils are suited to crops and pasture. Management concerns are wetness, water erosion, and soil blowing. The soils are suited to woodland. Major management concerns affecting woodland are equipment limitations, seedling mortality, the windthrow hazard, and plant competition. Most areas of these soils are poorly suited to building site development and septic tank absorption fields. Seasonal wetness, the slope, restricted permeability, and a moderate or high shrink-swell potential are limitations.

3. Algonquin-Negwegon-Springport Association

Nearly level and undulating, moderately well drained to poorly drained, loamy soils that formed in loamy and clayey sediments; on lake plains

The soils in this association are on broad low-lying plains. Slopes range from 0 to 6 percent.

This association makes up about 10 percent of the county. It is about 32 percent Algonquin soils, 21 percent Negwegon soils, 13 percent Springport soils, and 34 percent soils of minor extent (fig. 3).

Algonquin soils are nearly level and undulating and are somewhat poorly drained. Typically, the surface layer is dark brown, mottled silt loam about 7 inches thick. The subsoil is mottled. It extends to a depth of more than 60 inches. The upper part is reddish brown and light reddish brown silty clay and silty clay loam about 22 inches thick. The lower part is light reddish brown silty clay loam.

Negwegon soils are undulating and are moderately well drained. Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 38 inches thick. The upper part is reddish brown, mottled silty clay loam and brown silt loam. The lower part is reddish brown clay and silty clay. The substratum to a depth of about 60 inches is stratified brown silty clay loam and yellowish brown silt loam.

Springport soils are nearly level and are poorly drained. Typically, the surface layer is very dark gray clay loam about 8 inches thick. The subsoil is about 19 inches thick. It is mottled. The upper part is grayish brown clay. The lower part is reddish brown silty clay. The substratum to a depth of about 60 inches is reddish brown, mottled silty clay.

The most common soils of minor extent in this association are the moderately well drained Alcona and Hoist soils, the somewhat poorly drained Richter soils, and the poorly drained Tonkey soils. Alcona and Richter soils are in broad nearly level areas. Tonkey soils are in depressions and drainageways. Hoist soils are on knolls, ridges, and breaks to drainageways.

The soils in this association are used mainly as cropland or pasture. A few areas are used as woodland or as building sites.

The major soils are moderately well suited to crops and pasture. The major management concerns are overcoming the seasonal wetness and maintaining soil tilth. The hazard of erosion is an additional concern in areas of the Negwegon and Algonquin soils. If

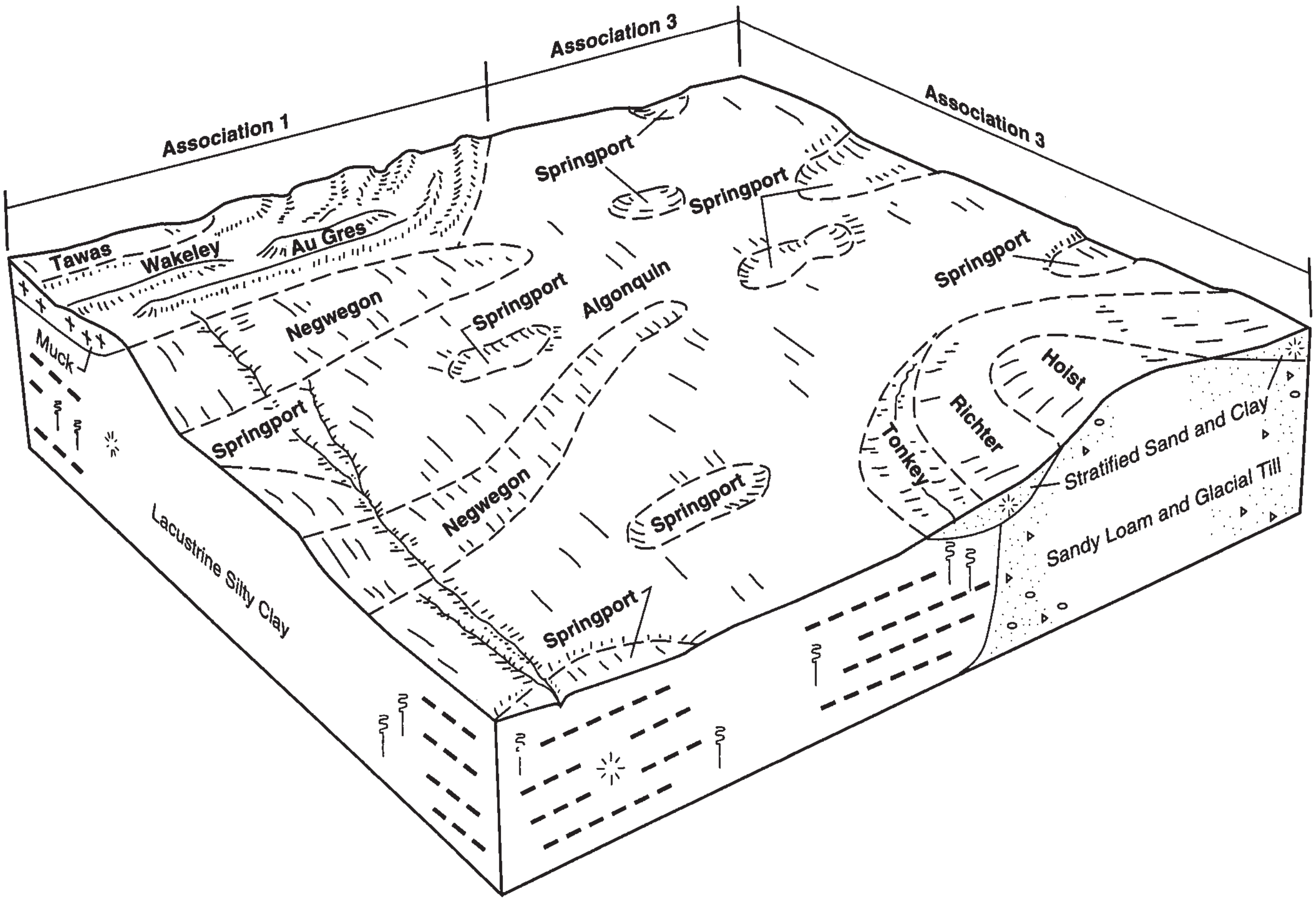

Figure 3.—Typical pattern of soils and parent material in the Algonquin-Negwegon-Springport association (adjacent to the Au Gres-Wakeley-Tawas association).

pastures are overgrazed, surface compaction is a management concern.

In areas used as woodland, the management concerns are equipment limitations, the windthrow hazard, seedling mortality, and plant competition.

The major soils are poorly suited or generally unsuited to building site development. The seasonal wetness, restricted permeability, and a high shrink-swell potential are limitations.

4. McGinn-Hoist-Klacking Association

Nearly level to rolling, moderately well drained and well drained, sandy and loamy soils that formed in sandy and loamy material; on ground moraines

The soils in this association are on knolls and ridges in the uplands. Slopes range from 0 to 18 percent.

This association makes up about 17 percent of the county. It is about 30 percent McGinn soils, 14 percent Hoist soils, 11 percent Klacking soils, and 45 percent soils of minor extent (fig. 4).

McGinn soils are well drained. Typically, the surface is covered with a layer of forest litter about 1 inch thick. The surface layer is black loamy sand about 1 inch thick. The subsurface layer is light brownish gray loamy sand about 2 inches thick. The subsoil is about 31 inches thick. The upper part is strong brown and dark yellowish brown loamy sand. The next part is mixed grayish brown loamy sand and reddish brown sandy loam. The lower part is reddish brown sandy loam. The substratum to a depth of about 80 inches is light reddish brown sandy loam.

Hoist soils are moderately well drained and well drained. Typically, the surface layer is very dark grayish brown sandy loam about 9 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish brown sandy loam. Below this is mixed brown and reddish brown sandy loam. The next part is reddish brown loam. The lower part is light reddish

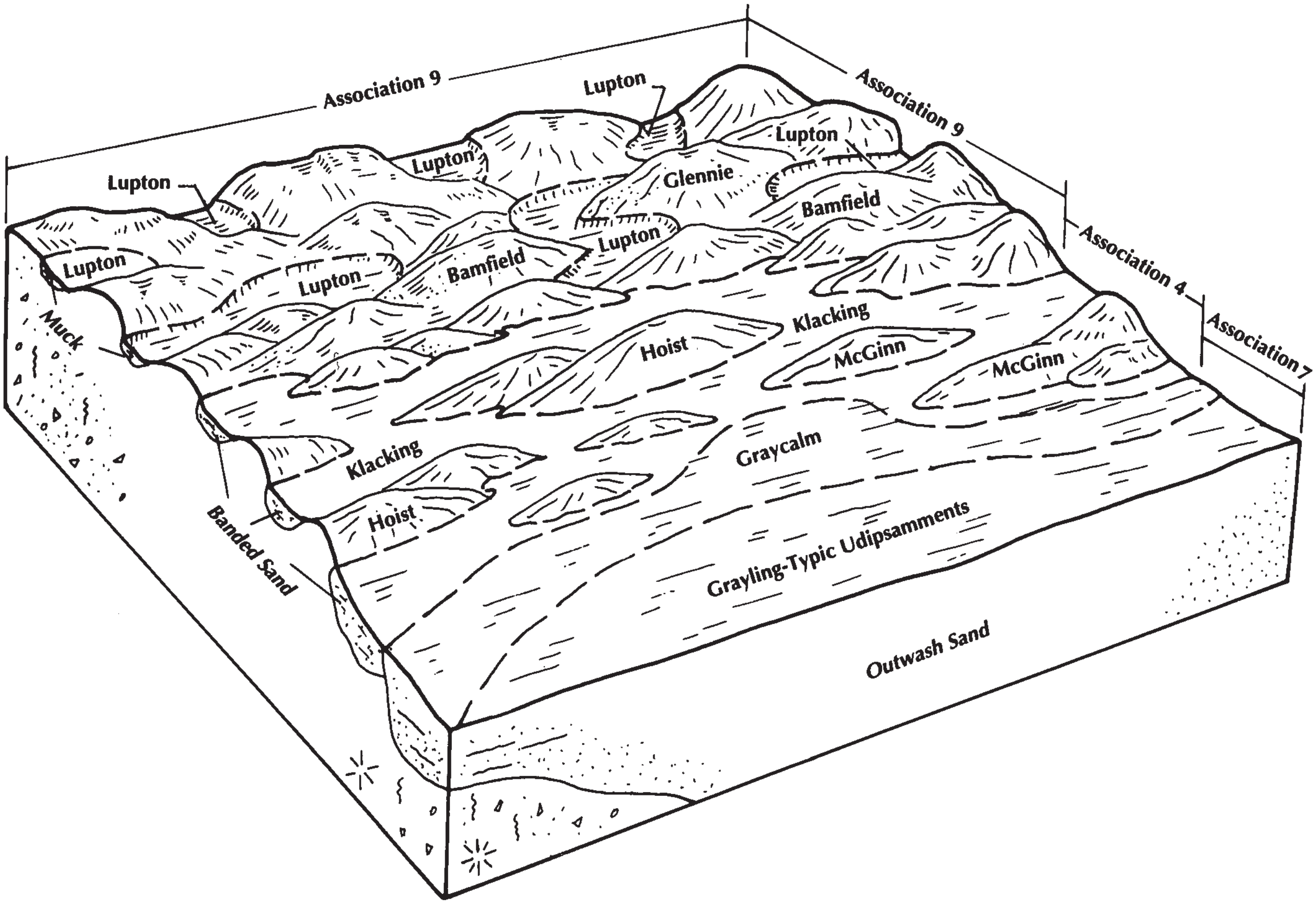

Figure 4.—Typical pattern of soils and parent material in the McGinn-Hoist-Klacking, Grayling-Graycalm-Typic Udipsamments, and Glennie-Bamfield-Lupton associations.

brown sandy loam that is mottled in places. The substratum to a depth of about 80 inches is light reddish brown sandy loam.

Klacking soils are well drained. Typically, the surface layer is black loamy sand about 2 inches thick. The subsurface layer is brown loamy sand about 1 inch thick. The subsoil extends to a depth of more than 60 inches. The upper part is dark yellowish brown and yellowish brown loamy sand. Below this is light yellowish brown loamy sand that has bands of dark brown sandy loam. The next part is dark brown sandy loam and light yellowish brown loamy sand. The lower part is light yellowish brown loamy sand that has bands of dark brown sandy loam.

The most common soils of minor extent are the somewhat excessively drained East Lake soils, the excessively drained Entic Haplorthods, the well drained Alfic Haplorthods, the somewhat poorly drained Killmaster soils, and the poorly drained Ensley soils. East Lake soils, Entic Haplorthods, and Alfic Haplorthods are in the same landscape positions as the major soils. Killmaster soils are on nearly level tops of ridges and on the lower side slopes. Ensley soils are in depressions.

The soils in this association are used as cropland, pasture, woodland, or building sites.

The major soils are moderately well suited to crops and pasture. The major management concerns are water erosion and soil blowing. The slope is a management concern in the rolling areas.

If the major soils are used as woodland, equipment limitations and plant competition are management concerns in areas of the Hoist soils. Seedling mortality and seasonal droughtiness are management concerns in areas of the Klacking soils.

The McGinn and Klacking soils are suited to building site development in nearly level areas. Seasonal wetness and the slope are limitations in most other areas of this association.

5. Bamfield-Nester-Glossic Eutroboralfs Association

Nearly level to gently rolling, moderately well drained and well drained, loamy soils that formed in loamy material; on ground moraines

The soils in this association are on knolls and ridges in the uplands. Slopes range from 0 to 12 percent.

This association makes up about 6 percent of the county. It is about 32 percent Bamfield soils, 19 percent Nester soils, 18 percent Glossic Eutroboralfs, and 31 percent soils of minor extent.

Bamfield soils are moderately well drained and well drained. Typically, the surface is covered with a layer of forest litter about 1 inch thick. The surface layer is very dark grayish brown fine sandy loam about 5 inches thick. The subsoil is more than 60 inches thick. In sequence downward, it is yellowish brown fine sandy loam; pinkish gray fine sandy loam; mixed reddish brown clay loam and pinkish gray fine sandy loam; reddish brown clay loam that is mottled in places; and light reddish brown clay loam.

Nester soils are moderately well drained and well drained. Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 31 inches thick. The upper part is mixed brown sandy loam and reddish brown, mottled clay loam. The next part is reddish brown, mottled clay loam. The lower part is reddish brown clay loam. The substratum to a depth of about 60 inches is light reddish brown clay loam.

Glossic Eutroboralfs are well drained. Typically, the surface layer is very dark gray sandy loam about 3 inches thick. The subsoil is about 40 inches thick. The upper part is brown and dark brown loamy sand. The next part is mixed reddish brown sandy clay loam and brown sandy loam. The lower part is reddish brown loamy sand. The substratum to a depth of about 80 inches is reddish brown loam.

Of minor extent in this association are the somewhat poorly drained Kawkawlin soils and the well drained Manistee soils and Arenic Eutroboralfs. Kawkawlin soils are in slightly depressional areas. Manistee soils and Arenic Eutroboralfs are in the same landscape positions as the major soils.

The soils in this association are used for crops and pasture (fig. 5), as woodland, or as building sites.

The major soils are moderately well suited to crops and pasture. The major management concern is controlling erosion.

If the major soils are used as woodland, equipment limitations and plant competition are management concerns.

These soils are only fairly well suited to building site development because of seasonal wetness, a moderate shrink-swell potential, and slow permeability.

6. Glennie-Sprinkler Association

Nearly level to gently rolling, moderately well drained and somewhat poorly drained, loamy soils that formed in sandy and loamy material; on ground moraines

The soils in this association are on broad plains in the uplands. Slopes range from 0 to 12 percent.

This association makes up about 2 percent of the county. It is about 75 percent Glennie soils, 15 percent Sprinkler soils, and 10 percent soils of minor extent.

Glennie soils are nearly level to gently rolling and are moderately well drained. Typically, the surface is covered with a layer of forest litter about 2 inches thick. The surface layer is black loamy sand about 1 inch thick. The subsurface layer is grayish brown loamy sand about 4 inches thick. The subsoil extends to a depth of more than 80 inches. In sequence downward, it is dark brown sandy loam and strong brown loamy sand; mixed brown loamy sand and reddish brown loam; mottled, mixed reddish brown sandy clay loam and brown sandy loam; mottled, dark reddish brown clay; and reddish brown sandy clay loam.

Sprinkler soils are nearly level and are somewhat poorly drained. Typically, the surface layer is very dark gray sandy loam about 5 inches thick. The subsurface layer is brown, mottled sandy loam about 8 inches thick. The subsoil is about 31 inches thick. It is mottled. The upper part is mixed brown sandy loam and brown loam. The next part is dark brown loam. The lower part is brown loam. The substratum to a depth of about 60 inches is brown, mottled loam.

Of minor extent in this association are the well drained Klacking soils and the very poorly drained Lupton soils. Klacking soils are in the same landscape positions as the Glennie soils. Lupton soils are in depressions.

The soils in this association are used as woodland. Some areas are used as pasture, cropland, or building sites.

The major soils are well suited to trees. Equipment limitations and plant competition are limitations.

The major soils are moderately well suited to crops and pasture. The major management concerns are water erosion and soil blowing on the Glennie soils and wetness on the Sprinkler soils.

The seasonal high water table, restricted permeability, and a moderate shrink-swell potential

Figure 5.—Grass-legume hay in an area of Nester soils. Bamfield soils are in the background.

are limitations if these soils are used as building sites.

Nearly Level to Hilly Soils That Are Excessively Drained to Well Drained

Most areas of these soils are used as woodland. Some areas are used as building sites. Equipment limitations and seedling mortality are management concerns. The soils are suited to building site development, but a poor filtering capacity can result in the contamination of local ground water.

7. Grayling-Graycalm-Typic Udipsamments Association

Nearly level and undulating, excessively drained and somewhat excessively drained, sandy soils that formed in sandy material; on deltas, outwash plains, and stream terraces

The soils in this association are on broad plains in the uplands. They are deeply dissected at widely spaced intervals by currently active drainageways. Slopes range from 0 to 6 percent.

This association makes up about 14 percent of the county. It is about 47 percent Grayling soils, 18 percent Graycalm soils, 18 percent Typic Udipsamments, and 17 percent soils of minor extent (fig. 4).

Grayling soils are excessively drained. Typically, the surface layer is black sand about 2 inches thick. The subsoil is about 27 inches thick. The upper part is dark yellowish brown sand. The lower part is yellowish brown sand. The substratum to a depth of about 80 inches is light yellowish brown sand.

Graycalm soils are somewhat excessively drained. Typically, the surface layer is black sand about 1 inch thick. The subsoil extends to a depth of more than 80 inches. The upper part is strong brown sand and loamy sand. The lower part is light yellowish brown sand that has bands of brown loamy sand.

Typic Udipsamments are excessively drained. Typically, the surface is covered with a layer of forest litter about 1 inch thick. The surface layer is very dark gray sand about 2 inches thick. The subsurface layer is light brownish gray sand about 2 inches thick. The subsoil is sand about 36 inches thick. The upper part is yellowish brown, and the lower part is brownish yellow. The substratum to a depth of about 80 inches is light yellowish brown sand.

The most common soils of minor extent are the somewhat excessively drained Mancelona soils; the moderately well drained Croswell and Chinwhisker soils; and strongly sloping to very steep soils on breaks to drainageways and on breaks to the lower or higher terraces. Mancelona soils are in the same landscape positions as the major soils. Croswell and Chinwhisker soils are in the slightly lower areas.

The major soils in this association are used mainly as woodland. Some areas are used as building sites.

The major soils are well suited to woodland. Equipment limitations and seedling mortality are management concerns.

Because of droughtiness and soil blowing, these soils are poorly suited to crops and pasture.

The major soils are well suited to use as building sites. The caving of cutbanks and a poor filtering capacity are concerns.

8. Klacking-Graycalm-Grayling Association

Gently rolling to hilly, excessively drained to well drained, sandy soils that formed in sandy material or sandy material underlain by loamy material; on moraines and outwash plains

The soils in this association are on ridges and knolls in the uplands. Slopes range from 6 to 25 percent.

This association makes up about 7 percent of the county. It is about 34 percent Klacking soils, 33 percent Graycalm soils, 10 percent Grayling soils, and 23 percent soils of minor extent.

Klacking soils are well drained. Typically, the surface layer is black loamy sand about 2 inches thick. The subsurface layer is brown loamy sand about 1 inch thick. The subsoil extends to a depth of more than 60 inches. In sequence downward, it is dark yellowish brown and yellowish brown loamy sand; light yellowish brown loamy sand that has bands of dark brown sandy loam; dark brown sandy loam and light yellowish brown loamy sand; and light yellowish brown loamy sand that has bands of dark brown sandy loam.

Graycalm soils are somewhat excessively drained. Typically, the surface layer is black sand about 1 inch thick. The subsoil extends to a depth of more than 80 inches. The upper part is strong brown sand and loamy sand. The lower part is light yellowish brown sand that has bands of brown loamy sand.

Grayling soils are excessively drained. Typically, the surface layer is black sand about 2 inches thick. The subsoil is sand about 27 inches thick. The upper part is dark yellowish brown, and the lower part is light yellowish brown. The substratum to a depth of about 80 inches is light yellowish brown sand.

The most common soils of minor extent are the somewhat excessively drained Mancelona soils, the excessively drained Typic Udipsamments, and the well drained Alfic Haplorthods. These soils are in landscape positions similar to those of the major soils.

The soils in this association are used mainly as woodland. Some areas are used as building sites.

The major soils are well suited to woodland. Equipment limitations and seedling mortality are management concerns.

Because of droughtiness, the slope, and soil blowing, these soils are poorly suited to crops and pasture.

The major soils are poorly suited to use as building sites. The slope is the main limitation. The caving of cutbanks and a poor filtering capacity are also concerns.

Nearly Level to Very Steep Soils That Are Very Poorly Drained, Moderately Well Drained, Well Drained, and Excessively Drained

Most areas of these soils are used as woodland. The soils are suited to trees. Because of the slope, equipment limitations and water erosion are the major management concerns. The soils are generally unsuited to cropland and to building site development because of the slope or wetness.

9. Glennie-Bamfield-Lupton Association

Nearly level to very steep, very poorly drained and well drained, mucky and loamy soils that formed in sandy and loamy material and organic material; on disintegration moraines and ground moraines

The Glennie and Bamfield soils in this association are on ridges and knolls in the uplands. The Lupton soils are in closed depressions in the uplands. Slopes range from 0 to 45 percent.

This association makes up about 6 percent of the county. It is about 31 percent Glennie soils, 23 percent Bamfield soils, 21 percent Lupton soils, and 25 percent soils of minor extent (fig. 4).

Glennie soils are steep and are well drained. Typically, the surface is covered with a layer of forest litter about 2 inches thick. The surface layer is black loamy sand about 1 inch thick. The subsurface layer is grayish brown loamy sand about 4 inches thick. The subsoil extends to a depth of more than 80 inches. In sequence downward, it is dark brown sandy loam and strong brown loamy sand; mixed brown loamy sand and reddish brown loam; mixed reddish brown sandy clay loam and brown sandy loam; dark reddish brown clay; and reddish brown sandy clay loam.

Bamfield soils are rolling to very steep and are well drained. Typically, the surface is covered with a layer of forest litter about 1 inch thick. The surface layer is very dark grayish brown fine sandy loam about 5 inches thick. The subsoil extends to a depth of more than 60 inches. In sequence downward, it is yellowish brown fine sandy loam; pinkish gray fine sandy loam; mixed reddish brown clay loam and pinkish gray fine sandy loam; reddish brown clay loam; and light reddish brown clay loam.

Lupton soils are nearly level and are very poorly drained. Typically, the surface layer is black muck about 5 inches thick. The underlying layers to a depth of about 60 inches are dark reddish brown muck.

The most common soils of minor extent are the well drained Alfic Haplorthods, Arenic Eutroboralfs, and Glossic Eutroboralfs. These soils are in landscape positions similar to those of the Glennie and Bamfield soils.

The soils in this association are used mainly as woodland. A few areas are used as building sites.

The Glennie and Bamfield soils are well suited to trees. The major concerns are the slope, plant competition, the windthrow hazard, the hazard of erosion, and equipment limitations. The Lupton soils are poorly suited to trees because of ponding.

The soils in this association are generally not suited to cropland. The slope is a limitation on the Glennie and Bamfield soils, and ponding is a concern on the Lupton soils.

The Glennie and Bamfield soils are poorly suited to building site development because of a moderate shrink-swell potential, the slope, and restricted permeability. The Lupton soils are generally unsuited to building site development because of ponding and low strength.

10. Alfic Haplorthods-Entic Haplorthods Association

Nearly level to steep, excessively drained and well drained, sandy soils that formed in sandy material and sandy over loamy material; on moraines

The soils in this association are on ridges and knolls in the uplands. Slopes range from 0 to 25 percent.

This association makes up about 3 percent of the county. It is about 85 percent Alfic Haplorthods, 12 percent Entic Haplorthods, and 3 percent soils of minor extent.

Alfic Haplorthods are well drained. Typically, the surface is covered with a layer of forest litter about 2 inches thick. The surface layer is very dark grayish brown loamy sand about 2 inches thick. The subsurface layer is grayish brown sand about 3 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown, strong brown, and yellowish brown sand, and the lower part is dark brown sandy loam. The substratum to a depth of about 180 inches is reddish yellow and brownish yellow sand.

Entic Haplorthods are excessively drained. Typically, the surface is covered with a layer of forest litter about 1 inch thick. The surface layer is black sand about 2 inches thick. The subsurface layer is brown sand about 4 inches thick. The subsoil is about 23 inches thick. It is dark brown, strong brown, and brownish yellow sand. The substratum to a depth of about 180 inches is very pale brown and light yellowish brown sand.

The most common soils of minor extent are the well drained Glossic Eutroboralfs. These soils are in landscape positions similar to those of the major soils.

The soils in this association are used as woodland.

The major soils are well suited to trees. The major management concerns are the slope, equipment limitations, the erosion hazard, and seedling mortality.

The major soils range from well suited to building site development to unsuited to this use.

11. Klacking-McGinn Association

Moderately sloping to very steep, well drained, sandy soils that formed in sandy and loamy material; on dissected moraines

The soils in this association are on ridges in the uplands. Slopes range from 8 to 50 percent.

This association makes up about 12 percent of the county. It is about 38 percent Klacking soils, 27 percent McGinn soils, and 35 percent soils of minor extent (fig. 6).

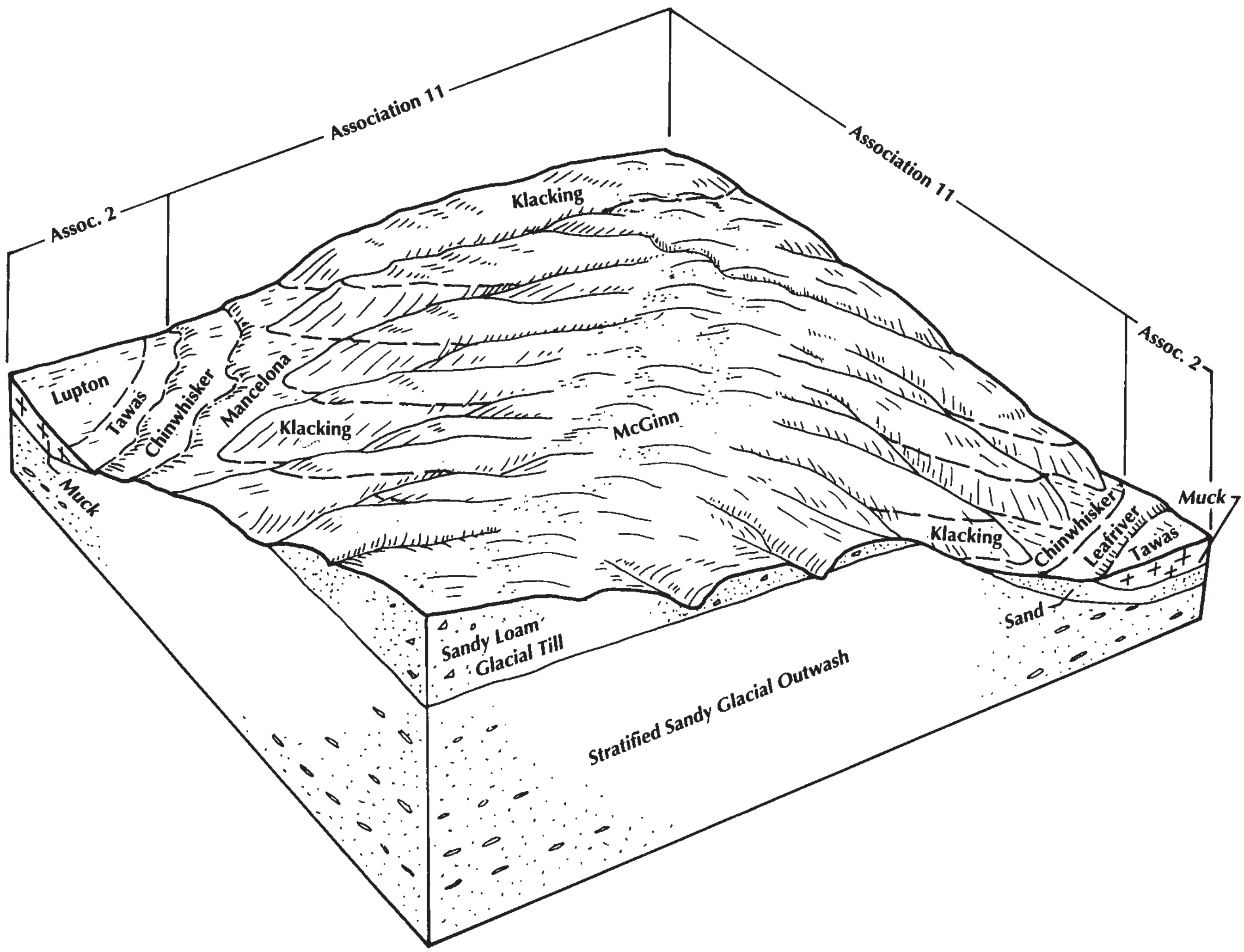

Figure 6.—Typical pattern of soils and parent material in the Klacking-McGinn association (adjacent to the Lupton-Tawas-Leafriver association).

Klacking soils are moderately sloping to very steep. Typically, the surface layer is black loamy sand about 2 inches thick. The subsurface layer is brown loamy sand about 1 inch thick. The subsoil extends to a depth of more than 60 inches. In sequence downward, it is dark yellowish brown and yellowish brown loamy sand; light yellowish brown loamy sand that has bands of dark brown sandy loam; dark brown sandy loam and light yellowish brown loamy sand; and light yellowish brown loamy sand that has bands of dark brown sandy loam.

McGinn soils are moderately sloping to steep. Typically, the surface is covered with a layer of forest litter about 1 inch thick. The surface layer is black loamy sand about 1 inch thick. The subsoil is about 31 inches thick. The upper part is strong brown and dark yellowish brown loamy sand. The next part is mixed grayish brown loamy sand and reddish brown sandy loam. The lower part is reddish brown sandy loam. The substratum to a depth of about 80 inches is light reddish brown sandy loam.

The most common soils of minor extent are the moderately well drained Chinwhisker soils, the well drained Hoist soils, and the somewhat excessively drained Alfic Haplorthods, Entic Haplorthods, and Mancelona soils. These soils are on nearly level to gently rolling terraces. Also of minor extent are nearly level to undulating areas of McGinn soils, which are commonly on ridgetops and hilltops.

The soils in this association are used as woodland.

The major soils are well suited to trees. The major management concerns are equipment limitations, the hazard of erosion, and seedling mortality.

The soils in this association are generally not suited to cropland because of the slope, the hazard of erosion, and droughtiness.

The major soils are generally unsuited to building site development because of the slope. Suitable building sites are in areas of the less sloping minor soils.

12. Zimmerman-Alcona Association

Gently rolling to very steep, moderately well drained to excessively drained, sandy soils that formed in stratified sandy and loamy material; on moraines

The soils in this association are on ridges in the uplands. Slopes range from 6 to 50 percent.

This association makes up about 3 percent of the county. It is about 57 percent Zimmerman soils, 31 percent Alcona soils, and 12 percent soils of minor extent.

Zimmerman soils are gently rolling to steep and are excessively drained. Typically, the surface layer is black loamy fine sand about 2 inches thick. The subsurface layer is grayish brown loamy fine sand about 2 inches thick. The subsoil extends to a depth of more than 80 inches. The upper part is strong brown loamy fine sand. The next part is yellowish brown loamy fine sand. The lower part is yellowish brown fine sand that has bands of strong brown loamy fine sand.

Alcona soils are strongly sloping to very steep and are moderately well drained and well drained. Typically, the surface layer is black loamy very fine sand about 1 inch thick. The subsurface layer is grayish brown loamy very fine sand about 2 inches thick. The subsoil is about 38 inches thick. In sequence downward, it is dark brown and yellowish brown loamy very fine sand; brown loamy very fine sand; brown loam and light yellowish brown very fine sandy loam that are mottled in places; and dark brown loam that is mottled in places. The substratum to a depth of about 60 inches is light yellowish brown loamy very fine sand that is mottled in places.

The most common soils of minor extent are the well drained Alfic Haplorthods and the excessively drained Typic Udipsamments. These soils are in nearly level to steep areas.

The soils in this association are used as woodland.

The major soils are well suited to trees. The major management concerns are equipment limitations, the hazard of erosion, and seedling mortality.

The soils in this association are generally not suited to cropland because of the slope, the hazard of erosion, and droughtiness.

The major soils are generally unsuited to building site development because of the slope.

Broad Land Use Considerations

The soils in Alcona County vary widely in their suitability for major land uses. The general soil map is helpful in identifying broad areas that can be developed for agriculture, forestry, wildlife habitat, industry, urban development, and other uses. It should not be used, however, in the selection of sites for specific structures or specific crops.

Cropland

About 13 percent of the county is farmland. Corn, small grain, and grass-legume hay are the major crops (fig. 7). The cropland is concentrated in associations 3, 4, 5, and 6. The major soils in these associations are generally suited to crops. The major soils in associations 3 and 5 are prime farmland. Maintaining soil tilth and controlling erosion and wetness are the main management concerns. The soils in associations 4 and 6 are areas of important farmland in Alcona County. Controlling water erosion, soil blowing, and wetness is the main management concern.

Crops are generally not grown in associations 1, 2, 7, 8, 9, 10, 11, and 12. The soils in associations 1 and 2 are difficult to drain because suitable outlets are not available. The soils in associations 7 and 8 are droughty. The soils in associations 9, 10, 11, and 12 are severely limited because of the slope.

Pasture

Associations 3, 4, 5, and 6 are generally suited to pasture. Wetness and surface compaction are management concerns in associations 3 and 5. The soils in associations 1 and 2 are too wet for use as pasture. Ground-water pollution from manure is a hazard. The soils in associations 7 and 8 are generally too droughty for the maintenance of forage plants. The soils in associations 9, 10, 11, and 12 are severely limited because of the slope.

Woodland

About 70 percent of Alcona County is forested. Most of the areas in associations 1, 2, 4, 7, 8, 9, 10, 11, and 12 are used for trees. Common trees in associations 1 and 2 are northern whitecedar on the very poorly drained soils and paper birch, red maple, and black ash on the somewhat poorly drained soils. Trees on the well drained and moderately well drained soils in associations 3 and 5 are sugar maple, American beech, white ash, and American basswood. Associations 4, 9, and 10 support sugar maple on the loamy soils and northern red oak on the sandy soils.

Figure 7.—Hay in an area of Negwegon and Algonquin soils. Maintaining soil tilth, controlling erosion, and overcoming the seasonal wetness are concerns in areas of these soils.

Paper birch and northern red oak are important trees on the major soils in association 6. The dominant trees in associations 7 and 8 are jack pine, black oak, and red pine. The major trees in associations 11 and 12 are northern red oak, red pine, and eastern white pine. Quaking aspen and bigtooth aspen grow on most of the soils in the county.

Wildlife Habitat

The soils in associations 1 and 2 are suited to wetland wildlife habitat. The soils in associations 3, 6, and 9 are suited to wetland wildlife habitat and woodland wildlife habitat. The major soils in associations 4, 8, 10, 11, and 12 are suited to woodland wildlife habitat. The soils in association 7 are poorly suited to wildlife habitat because of droughty conditions and because surface water is not available. The soils in association 7 support habitat for the Kirtland's warbler and other endangered species.

Building Site Development

The soils in associations 1 and 2 are poorly suited to unsuited to building site development because of wetness, ponding, or low strength. The somewhat poorly drained and moderately well drained soils in association 1 are extensively used as building sites in areas bordering lakes. Ground-water pollution from septic tank effluent is a hazard in these areas. The soils in associations 3, 5, and 6 are poorly suited to building site development because of wetness and a moderate or high shrink-swell potential. Restricted permeability and wetness are limitations affecting septic tank absorption fields. The soils in associations 4, 7, and 8 have few limitations affecting building site development. The pollution of ground water is a hazard in associations 7 and 8. The soils in associations 9, 10, 11, and 12 are generally unsuited to building site development because of the slope.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Graycalm sand, 18 to 35 percent slopes, is a phase of the Graycalm series.

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

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Algonquin-Springport complex, 0 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 similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Histosols and Aquents, ponded, is an undifferentiated group in this survey area.

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

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

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

11B—Eastport sand, 0 to 6 percent slopes

Setting

Landform: Beach ridges
Shape of areas: Elongated
Size of areas: 50 to 200 acres

Typical Profile

Surface layer:
0 to 1 inch—black sand

Subsurface layer:
1 to 8 inches—grayish brown sand

Subsoil:
8 to 14 inches—strong brown sand
14 to 23 inches—yellowish brown sand
23 to 29 inches—very pale brown sand

Substratum:
29 to 80 inches—very pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Very low
Drainage class: Excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Eastport soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Au Gres soils in depressions
- The moderately well drained Croswell soils in shallow depressions

Similar inclusions:
- Sandy soils that are somewhat excessively drained

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate.
- Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave
Management considerations:
- Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Poor filtering capacity
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 5S
Michigan soil management group: 5.3a

12B—Tawas-Au Gres complex, 0 to 4 percent slopes

Setting

Landform: Swale-ridge complex on a lake terrace; Tawas—in swales with slopes of 0 to 2 percent; Au Gres—on low ridges with slopes of 0 to 4 percent
Shape of areas: Elongated
Size of areas: 500 to 1,000 acres

Typical Profile

Tawas

Surface layer:
0 to 5 inches—black muck

Subsoil:
5 to 17 inches—black muck

Substratum:
17 to 60 inches—brown and dark brown sand

Au Gres

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 10 inches—pinkish gray sand

Subsoil:
10 to 14 inches—dark brown, mottled sand
14 to 27 inches—dark yellowish brown, mottled sand
27 to 33 inches—yellowish brown, mottled sand

Substratum:
33 to 60 inches—pale brown, mottled sand

Soil Properties and Qualities

Permeability: Tawas—moderately slow to moderately rapid in the mucky part, rapid in the sandy part; Au Gres—rapid
Available water capacity: Tawas—high; Au Gres—low
Drainage class: Tawas—very poorly drained; Au Gres—somewhat poorly drained
Seasonal high water table: Tawas—1.0 foot above to 1.0 foot below the surface from October through May; Au Gres—at a depth of 0.5 foot to 1.5 feet from October through May
Surface runoff: Tawas—ponded; Au Gres—very slow
Flooding: None
Organic matter content: Tawas—high; Au Gres—moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Tawas—moderate; Au Gres—severe
Shrink-swell potential: Low

Composition

Tawas soil and similar soils: 60 to 70 percent
Au Gres soil and similar soils: 25 to 35 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The very poorly drained Lupton soils, which have organic material more than 51 inches thick; in deep depressions between ridges

Similar inclusions:
• Soils that have organic layers less than 15 inches thick
• Sandy soils that have a calcareous substratum

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: Tawas—equipment limitation, windthrow hazard, plant competition, seedling mortality; Au Gres—equipment limitation, windthrow hazard, plant competition
Management considerations:
• Equipment should be used only when the soil is relatively dry or has an adequate snow cover.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• Trees that can withstand seasonal wetness should be selected for planting in areas of the Au Gres soil.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
• Because of wetness, seedling mortality, and plant competition, trees are generally not planted in areas of the Tawas soil.

Buildings

Major management concerns: Au Gres—seasonal wetness, cutbanks cave; Tawas—ponding (fig. 8)
Management considerations:
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Because of ponding, the Tawas soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Au Gres—poor filtering capacity, seasonal wetness; Tawas—ponding
Management considerations:
• Because of ponding, the Tawas soil is generally unsuited to septic tank absorption fields.
• The poor filtering capacity of the Au Gres soil can result in the pollution of ground water.
• Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: VIw
Woodland ordination symbol: Tawas—5W; Au Gres—6W
Michigan soil management group: Tawas—M/4c; Au Gres—5b

16B—Graycalm sand, 0 to 6 percent slopes

Setting

Landform: Outwash plains and stream terraces

Figure 8.—Areas of Tawas-Au Gres complex, 0 to 4 percent slopes, are near Lake Huron and are seemingly attractive building sites, but ponding in the lower areas is a common problem.

Shape of areas: Irregular
Size of areas: 50 to 1,000 acres

Typical Profile

Surface layer:
0 to 1 inch—black sand

Subsoil:
1 to 4 inches—strong brown sand
4 to 46 inches—strong brown loamy sand
46 to 80 inches—light yellowish brown sand that has bands of brown loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Graycalm soil and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in landscape positions similar to those of the Graycalm soil

Similar inclusions:
• Sandy soils that do not have bands of loamy sand in the substratum

Use and Management

Land use: Dominant use—woodland; other uses—building sites, pasture

Pasture

Major management concerns: Droughtiness, soil blowing

Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Poor filtering capacity
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 6S
Michigan soil management group: 5a

16C—Graycalm sand, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on outwash plains
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 1 inch—black sand

Subsoil:
1 to 4 inches—strong brown sand
4 to 46 inches—strong brown loamy sand

Substratum:
46 to 80 inches—light yellowish brown sand that has bands of brown loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Graycalm soil and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in landscape positions similar to those of the Graycalm soil
• The moderately well drained Glennie soils, which have a loamy and clayey subsoil; in landscape positions similar to those of the Graycalm soil

Similar inclusions:
• Sandy soils that do not have bands in the substratum

Use and Management

Land use: Dominant use—woodland; other uses—building sites, pasture

Pasture

Major management concerns: Droughtiness, soil blowing
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing,

maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Slope, poor filtering capacity
Management considerations:
• Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly.
• The poor filtering capacity can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 6S
Michigan soil management group: 5a

16D—Graycalm sand, 12 to 18 percent slopes

Setting

Landform: Ridges and knolls on outwash plains and stream terraces
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 1 inch—black sand

Subsoil:
1 to 4 inches—strong brown sand
4 to 46 inches—strong brown loamy sand

Substratum:
46 to 80 inches—light yellowish brown sand that has bands of brown loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Graycalm soil and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Glennie soils, which have a loamy and clayey subsoil; on the summits of knolls
• The well drained McGinn soils, which have a loamy subsoil; in landscape positions similar to those of the Graycalm soil
• The somewhat excessively drained Mancelona soils, which have a substratum of very gravelly sand; in landscape positions similar to those of the Graycalm soil

Similar inclusions:
• Sandy soils that do not have bands of loamy sand in the substratum

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Land shaping may be necessary to develop a suitable building site.

Septic tank absorption fields

Major management concerns: Slope, poor filtering capacity
Management considerations:
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.
• The poor filtering capacity can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 6S
Michigan soil management group: 5a

16E—Graycalm sand, 18 to 35 percent slopes

Setting

Landform: Escarpments on stream terraces
Shape of areas: Elongated
Size of areas: 5 to 30 acres

Typical Profile

Surface layer:
0 to 1 inch—black sand

Subsoil:
1 to 4 inches—strong brown sand
4 to 46 inches—strong brown loamy sand

Substratum:
46 to 80 inches—light yellowish brown sand that has bands of brown loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Graycalm soil and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in landscape positions similar to those of the Graycalm soil

Similar inclusions:
• Sandy soils that do not have bands of loamy sand in the substratum

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, erosion hazard, seedling mortality
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour

or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Seeding skid roads, logging roads, and landings after the trees are logged helps to control erosion. Some areas may require mulch.
• Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.
• Planting when the soil is moist can also reduce the seedling mortality rate.

Buildings

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 6R
Michigan soil management group: 5a

17B—Croswell sand, 0 to 6 percent slopes

Setting

Landform: Stream terraces and lake terraces
Shape of areas: Elongated and irregular
Size of areas: 20 to 300 acres

Typical Profile

Organic mat:
0 to 1 inch—black, well decomposed forest leaf litter

Surface layer:
1 to 4 inches—dark grayish brown sand

Subsoil:
4 to 10 inches—dark brown sand
10 to 20 inches—strong brown sand
20 to 29 inches—brownish yellow, mottled sand

Substratum:
29 to 80 inches—yellowish brown and light yellowish brown, mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Moderately well drained
Depth to the water table: 2 to 4 feet from October through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Croswell and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres and Battlefield soils on the lower slopes and in depressions
• The very poorly drained Leafriver soils in depressions

Similar inclusions:
• Soils that have a surface layer of loamy sand

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Available water capacity, low organic matter content, soil blowing, seasonal droughtiness, nutrient loss
Management considerations:
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and reduces the hazard of soil blowing.
• Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and can help to prevent ground-water pollution.
• Nutrients in manure and fertilizer applications should not exceed the nutrient requirements of the plants.

• Conservation tillage and additions of organic material increase the organic matter content and the available water capacity.

Pasture

Major management concerns: Droughtiness, soil blowing
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, plant competition
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Adequate site preparation controls initial plant competition, and spraying controls subsequent competition.

Buildings

Major management concerns: Cutbanks cave, seasonal wetness
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Poor filtering capacity, seasonal wetness
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 5S
Michigan soil management group: 5a

18A—Au Gres sand, 0 to 3 percent slopes

Setting

Landform: Stream terraces and lake terraces
Shape of areas: Irregular
Size of areas: 5 to 200 acres

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 10 inches—pinkish gray sand

Subsoil:
10 to 14 inches—dark brown, mottled sand
14 to 27 inches—dark yellowish brown, mottled sand
27 to 33 inches—yellowish brown, mottled sand

Substratum:
33 to 60 inches—pale brown, mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat poorly drained
Depth to the water table: 0.5 foot to 1.5 feet from October through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Au Gres and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The excessively drained Grayling soils on low knolls and ridges
- The very poorly drained Leafriver soils in depressions

Similar inclusions:
- Sandy soils that are moderately well drained

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Available water capacity, seasonal wetness, soil blowing, nutrient loss
Management considerations:
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and reduces the hazard of soil blowing.
- Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.
- Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and can help to prevent ground-water pollution.
- Subsurface drains can reduce the wetness if a suitable outlet is available.

Pasture

Major management concerns: Droughtiness, soil blowing, seasonal wetness
Management considerations:
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing, maintain plant density and hardiness, and help to keep the pasture in good condition.
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, plant competition
Management considerations:
- Equipment can be used only during dry summer months and during periods in winter when the snow cover is adequate or the soil is frozen.
- Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
- After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
- Special harvest methods may be needed to control undesirable plants.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave, seasonal wetness
Management considerations:
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Poor filtering capacity, seasonal wetness
Management considerations:
- Mounding or adding suitable fill material helps to raise the absorption field above the water table.
- The poor filtering capacity can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: IVw
Woodland ordination symbol: 6W
Michigan soil management group: 5b

19—Leafriver muck

Setting

Landform: Depressions on lake plains and outwash plains
Slope: 0 to 1 percent
Shape of areas: Elongated and irregular

Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 9 inches—black muck

Subsoil:
9 to 21 inches—brown, mottled sand

Substratum:
21 to 27 inches—grayish brown, mottled sand
27 to 60 inches—dark grayish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Moderate
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Very slow or ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Leafriver and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils

Similar inclusions:
• Soils that have a thicker organic surface layer
• Sandy soils that are poorly drained

Use and Management

Land use: Dominant use—woodland; other use—abandoned cropland

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, plant competition
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
• Landing sites generally can be used only during the driest time of the year.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

Building sites

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIw
Woodland ordination symbol: 2W
Michigan soil management group: 5c

26B—Croswell sand, loamy substratum, 0 to 6 percent slopes

Setting

Landform: Lake terraces
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 1 inch—dark brown sand

Subsurface layer:
1 to 6 inches—pinkish gray sand

Subsoil:
6 to 20 inches—dark brown sand
20 to 35 inches—strong brown sand

Substratum:
35 to 50 inches—yellowish brown, mottled sand

50 to 55 inches—stratified, mottled pale brown sand and strong brown sandy loam
55 to 60 inches—brown, mottled silty clay loam

Soil Properties and Qualities

Permeability: Rapid in the sandy part; moderately slow in the loamy substratum
Available water capacity: Low
Drainage class: Moderately well drained
Seasonal high water table: Perched at a depth of 2 to 4 feet from October through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Croswell and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The very poorly drained Wakeley soils in depressions

Similar inclusions:
• Soils that have more clay in the substratum
• Soils that have a surface layer of loamy sand

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Available water capacity, low organic matter content, soil blowing, seasonal droughtiness, nutrient loss
Management considerations:
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.
• Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and can help to prevent ground-water pollution.
• Nutrients in manure and fertilizer applications should not exceed the nutrient requirements of the plants.
• Conservation tillage and additions of organic material increase the organic matter content and the available water capacity.

Pasture

Major management concerns: Droughtiness, soil blowing
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, seedling mortality, plant competition
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Adequate site preparation controls initial plant competition, and spraying controls subsequent competition.

Buildings

Major management concerns: Cutbanks cave, seasonal wetness
Management considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Poor filtering capacity, moderately slow permeability, seasonal wetness
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Mounding or adding suitable fill material helps to raise the absorption field above the water table and increases the thickness of the filtering material.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter

of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 7S
Michigan soil management group: 5a

27A—Au Gres sand, clayey substratum, 0 to 3 percent slopes

Setting

Landform: Lake terraces
Shape of areas: Irregular
Size of areas: 5 to 100 acres

Typical Profile

Organic mat:
0 to 1 inch—black, partially decomposed forest leaf litter

Surface layer:
1 to 15 inches—dark gray and light gray sand

Subsoil:
15 to 23 inches—very dusky red and strong brown, mottled sand
23 to 32 inches—pale brown, mottled sand and loamy sand
32 to 44 inches—strong brown and grayish brown, mottled loamy sand

Substratum:
44 to 58 inches—pinkish gray sand
58 to 80 inches—reddish brown, mottled silty clay

Soil Properties and Qualities

Permeability: Rapid in the sandy part; very slow in the silty clay part
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: Perched at a depth of 0.5 foot to 1.5 feet from October through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low in the upper part; high in the silty clay part of the substratum

Composition

Au Gres and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The very poorly drained Wakeley soils in depressions

Similar inclusions:
• Soils that are moderately well drained
• Soils that have less clay in the substratum

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building sites

Pasture

Major management concerns: Droughtiness, soil blowing, seasonal wetness
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants.

Woodland

Major management concerns: Equipment limitation, plant competition
Management considerations:
• Equipment can be used only during dry summer months and during periods in winter when the snow cover is adequate or the soil is frozen.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.

Buildings

Major management concerns: Cutbanks cave, seasonal wetness
Management considerations:
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Poor filter, very slow permeability, seasonal wetness

Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Increasing the size of the absorption area helps to compensate for the restricted permeability.
• Mounding or adding suitable fill material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: IVw
Woodland ordination symbol: 7W
Michigan soil management group: 5b

28B—East Lake sand, 0 to 6 percent slopes

Setting

Landform: Outwash plains and lake terraces
Shape of areas: Irregular
Size of areas: 10 to 300 acres

Typical Profile

Surface layer:
0 to 4 inches—black sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 12 inches—dark brown loamy sand
12 to 20 inches—strong brown loamy sand
20 to 30 inches—strong brown sand

Substratum:
30 to 60 inches—brown, stratified sand and very gravelly loamy coarse sand

Soil Properties and Qualities

Permeability: Rapid in the surface layer and subsoil; very rapid in the substratum
Available water capacity: Very low
Drainage class: Somewhat excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

East Lake and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Battlefield soils in depressions
• The very poorly drained Wheatley soils in depressions and drainageways

Similar inclusions:
• Soils that have a loamy layer in the subsoil
• Soils that have a surface layer of loamy sand

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building sites

Pasture

Major management concerns: Droughtiness, soil blowing
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Poor filtering capacity
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter

of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 2S
Michigan soil management group: 5a

28C—East Lake sand, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on outwash plains and lake terraces
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 4 inches—black sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 12 inches—dark brown loamy sand
12 to 20 inches—strong brown loamy sand
20 to 30 inches—strong brown sand

Substratum:
30 to 60 inches—brown, stratified sand and very gravelly loamy coarse sand

Soil Properties and Qualities

Permeability: Rapid in the surface layer and subsoil; very rapid in the substratum
Available water capacity: Very low
Drainage class: Somewhat excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

East Lake and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Battlefield soils in depressions
• The very poorly drained Wheatley soils in depressions and drainageways

Similar inclusions:
• Soils that have a loamy layer in the subsoil
• Soils that have a surface layer of loamy sand

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building sites

Pasture

Major management concerns: Droughtiness, soil blowing
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Poor filtering capacity, slope
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
• Land shaping and installing the distribution lines

across the slope help to ensure that the absorption field functions properly.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 2S
Michigan soil management group: 5a

28E—East Lake sand, 12 to 35 percent slopes

Setting

Landform: Ridges and escarpments on outwash plains
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 4 inches—black sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 12 inches—dark brown loamy sand
12 to 20 inches—strong brown loamy sand
20 to 30 inches—strong brown sand

Substratum:
30 to 60 inches—brown, stratified sand and very gravelly loamy coarse sand

Soil Properties and Qualities

Permeability: Rapid in the surface layer and subsoil; very rapid in the substratum
Available water capacity: Very low
Drainage class: Somewhat excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

East Lake and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Graycalm soils, which do not have a very gravelly substratum; in landscape positions similar to those of the East Lake soil

Similar inclusions:
• Soils that have a loamy layer in the subsoil

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Erosion hazard, equipment limitation, seedling mortality
Management considerations:
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Buildings

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is poorly suited to building sites unless extensive land shaping is applied.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 2R
Michigan soil management group: 5a

29A—Battlefield sand, 0 to 3 percent slopes

Setting

Landform: Lake terraces and outwash plains

Shape of areas: Elongated
Size of areas: 10 to 200 acres

Typical Profile

Surface layer:
0 to 6 inches—black sand

Subsurface layer:
6 to 9 inches—pinkish gray sand

Subsoil:
9 to 10 inches—dark brown sand
10 to 26 inches—strong brown, mottled sand
26 to 33 inches—brown, mottled sand

Substratum:
33 to 60 inches—brown gravelly coarse sand

Soil Properties and Qualities

Permeability: Rapid in the surface layer and subsoil; very rapid in the substratum
Available water capacity: Very low
Drainage class: Somewhat poorly drained
Depth to the water table: 0.5 foot to 1.5 feet from October through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Battlefield and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils on low knolls or ridges
- The very poorly drained Leafriver and Wheatley soils in depressions and swales

Similar inclusions:
- Soils that have a loamy layer in the subsoil

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building sites

Pasture

Major management concerns: Droughtiness, soil blowing, seasonal wetness
Management considerations:
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing, maintain plant density and hardiness, and help to keep the pasture in good condition.
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, plant competition
Management considerations:
- Equipment can be used only during dry summer months and during periods in winter when the snow cover is adequate or the soil is frozen.
- Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
- After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
- Special harvest methods may be needed to control undesirable plants.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave, wetness
Management considerations:
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Poor filtering capacity, seasonal wetness
Management considerations:
- Mounding or adding suitable fill material helps to raise the absorption field above the water table.
- The poor filtering capacity can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: IVw
Woodland ordination symbol: 5W
Michigan soil management group: 5b

30—Wheatley muck

Setting

Landform: Depressions on lake terraces and in glacial drainageways
Slope: 0 to 1 percent
Shape of areas: Elongated and irregular
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 5 inches—black muck

Substratum:
5 to 9 inches—gray, mottled sand
9 to 34 inches—brown, mottled sand
34 to 60 inches—greenish gray gravelly sand

Soil Properties and Qualities

Permeability: Rapid in the sandy part; very rapid in the lower part of the substratum
Available water capacity: Moderate
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Wheatley and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The very poorly drained Leafriver soils, which are sandy throughout; in landscape positions similar to those of the Wheatley soil
• The somewhat poorly drained Battlefield soils on low ridges

Similar inclusions:
• Soils that have a loamy layer in the subsoil

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, plant competition
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
• Landing sites generally can be used only during the driest time of the year.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

Buildings

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 2W
Michigan soil management group: 5c

31B—Klacking loamy sand, 0 to 6 percent slopes

Setting

Landform: Outwash plains

Shape of areas: Irregular
Size of areas: 10 to 300 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 3 inches—brown loamy sand

Subsoil:
3 to 19 inches—dark yellowish brown loamy sand
19 to 27 inches—yellowish brown loamy sand
27 to 40 inches—light yellowish brown loamy sand that has bands of dark brown sandy loam
40 to 46 inches—dark brown sandy loam and light yellowish brown loamy sand
46 to 60 inches—light yellowish brown loamy sand that has bands of dark brown sandy loam

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Klacking and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained McGinn soils, which have more clay in the subsoil than the Klacking soil; on knolls
• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in landscape positions similar to those of the Klacking soil

Similar inclusions:
• Soils that have thinner bands of sandy loam in the substratum

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Seasonal droughtiness, soil blowing, low organic matter content
Management considerations:
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and reduces the hazard of soil blowing.
• Conservation tillage and additions of organic material increase the organic matter content and the available water capacity.

Pasture

Major management concerns: Seasonal droughtiness, soil blowing, overgrazing
Management considerations:
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Seedling mortality
Management considerations:
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: None

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: 6S
Michigan soil management group: 4a

31C—Klacking loamy sand, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on outwash plains and disintegration moraines

Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 3 inches—brown loamy sand

Subsoil:
3 to 19 inches—dark yellowish brown loamy sand
19 to 27 inches—yellowish brown loamy sand
27 to 40 inches—light yellowish brown loamy sand that has bands of dark brown sandy loam
40 to 46 inches—dark brown sandy loam and light yellowish brown loamy sand
46 to 60 inches—light yellowish brown loamy sand that has bands of dark brown sandy loam

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Klacking and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained McGinn soils, which have more clay in the subsoil than the Klacking soil; in landscape positions similar to those of the Klacking soil
• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in landscape positions similar to those of the Klacking soil

Similar inclusions:
• Soils that have thinner bands of sandy loam in the substratum

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building sites

Pasture

Major management concerns: Droughtiness, soil blowing
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Seedling mortality
Management considerations:
• Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.
• Planting when the soil is moist can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 6S
Michigan soil management group: 4a

31D—Klacking loamy sand, 12 to 18 percent slopes

Setting

Landform: Ridges and knolls on disintegration moraines
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 3 inches—brown loamy sand

Subsoil:
3 to 19 inches—dark yellowish brown loamy sand
19 to 27 inches—yellowish brown loamy sand
27 to 40 inches—light yellowish brown loamy sand that has bands of dark brown sandy loam
40 to 46 inches—dark brown sandy loam and light yellowish brown loamy sand
46 to 60 inches—light yellowish brown loamy sand that has bands of dark brown sandy loam

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Klacking and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained McGinn soils, which have more clay in the subsoil than the Klacking soil; in landscape positions similar to those of the Klacking soil
• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in landscape positions similar to those of the Klacking soil

Similar inclusions:
• Soils that have thinner bands of sandy loam in the substratum

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: Seedling mortality
Management considerations:
• Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.
• Planting when the soil is moist can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because of the slope, this soil is poorly suited to building sites unless extensive land shaping is applied.
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 6S
Michigan soil management group: 4a

31E—Klacking loamy sand, 18 to 35 percent slopes

Setting

Landform: Ridges and hills on disintegration moraines
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 3 inches—brown loamy sand

Subsoil:
3 to 19 inches—dark yellowish brown loamy sand
19 to 27 inches—yellowish brown loamy sand
27 to 40 inches—light yellowish brown loamy sand that has bands of dark brown sandy loam
40 to 46 inches—dark brown sandy loam and light yellowish brown loamy sand
46 to 60 inches—light yellowish brown loamy sand that has bands of dark brown sandy loam

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained

Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Klacking and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained McGinn soils, which have more clay in the subsoil than the Klacking soil; in landscape positions similar to those of the Klacking soil
• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in landscape positions similar to those of the Klacking soil

Similar inclusions:
• Soils that have thinner bands of sandy loam in the substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• Because slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.
• Planting when the soil is moist can also reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Buildings

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 6R
Michigan soil management group: 4a

33B—Mancelona loamy sand, 0 to 6 percent slopes

Setting

Landform: Stream terraces and terraces of glacial drainageways
Shape of areas: Irregular
Size of areas: 50 to 500 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 5 inches—dark grayish brown loamy sand

Subsoil:
5 to 16 inches—dark yellowish brown loamy sand
16 to 31 inches—yellowish brown sand
31 to 36 inches—dark brown very gravelly sandy loam
36 to 39 inches—dark brown very gravelly sandy clay loam

Substratum:
39 to 60 inches—light yellowish brown, stratified very gravelly sand and sand

Soil Properties and Qualities

Permeability: Moderately rapid in the surface layer and subsoil; very rapid in the substratum
Available water capacity: Low
Drainage class: Somewhat excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Mancelona and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Graycalm soils, which do not have very gravelly sand in the substratum; in landscape positions similar to those of the Mancelona soil
• The moderately well drained Glennie and well drained McGinn soils, which have a loamy substratum; in landscape positions similar to those of the Mancelona soil

Similar inclusions:
• Soils that are somewhat poorly drained
• Soils that do not have a loamy layer in the subsoil

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Seasonal droughtiness, soil blowing, low organic matter content, available water capacity, nutrient loss
Management considerations:
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and reduces the hazard of soil blowing.
• Conservation tillage, vegetative barriers, and cover crops help to control soil blowing.
• Conservation tillage and additions of organic material increase the organic matter content and the available water capacity.
• Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and can help to prevent ground-water pollution.

Pasture

Major management concerns: Seasonal droughtiness, soil blowing, overgrazing
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: None

Buildings

Major management concerns: Cutbanks cave
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Poor filtering capacity
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: 3A
Michigan soil management group: 4a

33C—Mancelona loamy sand, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on stream terraces and terraces of glacial drainageways
Shape of areas: Irregular
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 5 inches—dark grayish brown loamy sand

Subsoil:
5 to 16 inches—dark yellowish brown loamy sand
16 to 31 inches—yellowish brown sand
31 to 36 inches—dark brown very gravelly sandy loam
36 to 39 inches—dark brown very gravelly sandy clay loam

Substratum:
39 to 60 inches—light yellowish brown, stratified very gravelly sand and sand

Soil Properties and Qualities

Permeability: Moderately rapid in the surface layer and subsoil; very rapid in the substratum

Available water capacity: Low
Drainage class: Somewhat excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Mancelona and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Graycalm soils, which do not have very gravelly sand in the substratum; in landscape positions similar to those of the Mancelona soil
• The moderately well drained Glennie and well drained McGinn soils, which have a loamy substratum; in landscape positions similar to those of the Mancelona soil

Similar inclusions:
• Soils that do not have a loamy layer in the subsoil

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Seasonal droughtiness, soil blowing, low organic matter content, available water capacity, nutrient loss
Management considerations:
• Conservation tillage and additions of organic material increase the organic matter content and the available water capacity.
• Conservation tillage, vegetative barriers, and cover crops help to control soil blowing.
• Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and can help to prevent ground-water pollution.

Pasture

Major management concerns: Seasonal droughtiness, soil blowing, overgrazing
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: None

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Poor filtering capacity, slope
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
• Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 3A
Michigan soil management group: 4a

33D—Mancelona loamy sand, 12 to 18 percent slopes

Setting

Landform: Ridges and knolls on stream terraces and terraces of glacial drainageways
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 5 inches—dark grayish brown loamy sand

Subsoil:
5 to 16 inches—dark yellowish brown loamy sand

16 to 31 inches—yellowish brown sand
31 to 36 inches—dark brown very gravelly sandy loam
36 to 39 inches—dark brown very gravelly sandy clay loam

Substratum:
39 to 60 inches—light yellowish brown, stratified very gravelly sand and sand

Soil Properties and Qualities

Permeability: Moderately rapid in the surface layer and subsoil; very rapid in the substratum
Available water capacity: Low
Drainage class: Somewhat excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Mancelona and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Glennie and McGinn soils, which have a loamy substratum; in landscape positions similar to those of the Mancelona soil

Similar inclusions:
• Soils that do not have a loamy layer in the subsoil

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: None

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Land shaping may be necessary to develop a suitable building site.

Septic tank absorption fields

Major management concerns: Poor filtering capacity, slope
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 3A
Michigan soil management group: 4a

33E—Mancelona loamy sand, 18 to 35 percent slopes

Setting

Landform: Ridges and escarpments on stream terraces and terraces of glacial drainageways
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 5 inches—dark grayish brown loamy sand

Subsoil:
5 to 16 inches—dark yellowish brown loamy sand
16 to 31 inches—yellowish brown sand
31 to 36 inches—dark brown very gravelly sandy loam
36 to 39 inches—dark brown very gravelly sandy clay loam

Substratum:
39 to 60 inches—light yellowish brown, stratified very gravelly sand and sand

Soil Properties and Qualities

Permeability: Moderately rapid in the surface layer and subsoil; very rapid in the substratum
Available water capacity: Low
Drainage class: Somewhat excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate

Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Mancelona and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The well drained Glennie and McGinn soils, which have a loamy substratum; in landscape positions similar to those of the Mancelona soil
• The somewhat excessively drained Graycalm soils, which do not have very gravelly sand in the substratum; in landscape positions similar to those of the Mancelona soil

Similar inclusions:
• Soils that do not have a loamy layer in the subsoil

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, erosion hazard
Management considerations:
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The grade should be kept as low as possible.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• Because of the erosion hazard, skid roads and trails should be established on the contour and water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures.

Buildings

Major management concerns: Slope, cutbanks cave
Management considerations:
• Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 3R
Michigan soil management group: 4a

35—Kinross muck

Setting

Landform: Depressions on lake plains and outwash plains
Slope: 0 to 1 percent
Shape of areas: Irregular
Size of areas: 5 to 150 acres

Typical Profile

Surface layer:
0 to 3 inches—black muck

Subsurface layer:
3 to 8 inches—pinkish gray, mottled fine sand

Subsoil:
8 to 14 inches—dark reddish brown, mottled fine sand
14 to 22 inches—dark brown fine sand
22 to 26 inches—dark yellowish brown, mottled fine sand
26 to 30 inches—yellowish brown, mottled fine sand

Substratum:
30 to 60 inches—light brownish gray fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Kinross and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils on low ridges

• The very poorly drained Loxley soils, which have thick organic layers; in the slightly lower landscape positions

Similar inclusions:
• Soils that have medium sand in the subsoil and substratum

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, plant competition
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
• Landing sites generally can be used only during the driest time of the year.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

Buildings

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIw
Woodland ordination symbol: 2W
Michigan soil management group: 5c-a

36B—Alcona loamy very fine sand, moderately wet, 0 to 6 percent slopes

Setting

Landform: Lake terraces and deltas
Shape of areas: Irregular
Size of areas: 35 to 200 acres

Typical Profile

Surface layer:
0 to 1 inch—black loamy very fine sand

Subsurface layer:
1 to 3 inches—grayish brown loamy very fine sand

Subsoil:
3 to 8 inches—dark brown loamy very fine sand
8 to 12 inches—yellowish brown loamy very fine sand
12 to 16 inches—brown loamy very fine sand
16 to 21 inches—brown, mottled loam and light yellowish brown, mottled very fine sandy loam
21 to 41 inches—dark brown, mottled loam

Substratum:
41 to 60 inches—light yellowish brown, mottled loamy very fine sand

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Perched at a depth of 2.5 to 6.0 feet from November through May
Surface runoff: Slow
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Alcona and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The excessively drained Zimmerman soils in landscape positions similar to those of the Alcona soil
• The moderately well drained Negwegon soils in landscape positions similar to those of the Alcona soil

Similar inclusions:
• Soils that have more silt in the substratum

Use and Management

Land use: Dominant uses—woodland, pasture; other uses—cropland, building sites

Cropland

Major management concerns: Water erosion, soil blowing
Management considerations:
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.
• Wetness may delay site preparation and planting in the spring.

Pasture

Major management concerns: Overgrazing, seasonal wetness, seasonal droughtiness
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants.

Woodland

Major management concerns: Equipment limitation, plant competition
Management considerations:
• Skidders should not be used during wet periods, when ruts form easily. Year-round logging roads require a gravel base.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Cutbanks cave, seasonal wetness
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Seasonal wetness
Management considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 3L
Michigan soil management group: 3a-s

36C—Alcona loamy very fine sand, moderately wet, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on lake terraces and deltas
Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 1 inch—black loamy very fine sand

Subsurface layer:
1 to 3 inches—grayish brown loamy very fine sand

Subsoil:
3 to 8 inches—dark brown loamy very fine sand
8 to 12 inches—yellowish brown loamy very fine sand
12 to 16 inches—brown loamy very fine sand
16 to 21 inches—brown, mottled loam and light yellowish brown, mottled very fine sandy loam
21 to 41 inches—dark brown, mottled loam

Substratum:
41 to 60 inches—light yellowish brown, mottled loamy very fine sand

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Perched at a depth of 2.5 to 6.0 feet from November through May
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate

Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Alcona and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The excessively drained Zimmerman soils in landscape positions similar to those of the Alcona soil
• The moderately well drained Negwegon soils in landscape positions similar to those of the Alcona soil

Similar inclusions:
• Soils that have more silt in the substratum

Use and Management

Land use: Dominant use—woodland; other uses—pasture, cropland, building sites

Cropland

Major management concerns: Water erosion, soil blowing
Management considerations:
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.
• Wetness may delay site preparation and planting in the spring.

Pasture

Major management concerns: Erosion hazard, overgrazing, seasonal wetness, seasonal droughtiness
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants.

Woodland

Major management concerns: Equipment limitation, plant competition, erosion hazard
Management considerations:
• Skidders should not be used during wet periods, when ruts form easily. Year-round logging roads require a gravel base.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Seasonal wetness
Management considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 3L
Michigan soil management group: 3a-s

37A—Richter loamy fine sand, 0 to 3 percent slopes

Setting

Landform: Lake plains and glacial drainageways
Shape of areas: Irregular
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 8 inches—black loamy fine sand

Subsurface layer:
8 to 12 inches—light gray loamy sand

Subsoil:
12 to 18 inches—dark brown, mottled loamy sand
18 to 26 inches—brown, mottled sandy loam and pale brown, mottled loamy sand

26 to 37 inches—stratified, mottled brown fine sandy loam and reddish brown clay loam

Substratum:
37 to 60 inches—stratified, mottled pinkish gray loamy sand and reddish brown silt loam

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Somewhat poorly drained
Depth to the water table: 0.5 foot to 1.5 feet from October through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Richter and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The excessively drained Zimmerman and moderately well drained Hoist soils in the higher positions on the landscape

Similar inclusions:
• Soils that are moderately well drained
• Soils that have more sand throughout
• Soils that have more clay throughout

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Seasonal wetness, soil blowing
Management considerations:
• A subsurface drainage system can lower the water table.
• Subsurface drainage systems should be designed so that the rate of flowing water helps to keep fine sand and silt from plugging the tile lines. Also, suitable filtering material may be needed to keep the silt and fine sand from flowing into the tile lines.
• In some areas, improving drainage is difficult because adequate subsurface outlets are not available.
• Conservation tillage, windbreaks, vegetative barriers, cover crops, stripcropping, and cropping systems that include close-growing crops help to control soil blowing.

Pasture

Major management concerns: Seasonal wetness, overgrazing
Management considerations:
• Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants.

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, plant competition
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Trees that can withstand seasonal wetness should be selected for planting.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• Carefully managed reforestation helps to control undesirable understory plants.

Buildings

Major management concerns: Seasonal wetness, cutbanks cave
Management considerations:
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Seasonal wetness
Management considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: IIw

Woodland ordination symbol: 3W
Michigan soil management group: 3b-s

38—Tonkey silt loam

Setting

Landform: Depressions on lake plains, on outwash plains, and in glacial drainageways
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 6 inches—black, mottled silt loam

Subsoil:
6 to 12 inches—pinkish gray, mottled very fine sandy loam
12 to 26 inches—stratified, mottled brown very fine sandy loam and brown silt loam

Substratum:
26 to 60 inches—stratified, mottled brown very fine sandy loam, silt loam, and silt

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Very slow or ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Slight
Shrink-swell potential: Low

Composition

Tonkey and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The poorly drained Ensley soils, which are not stratified in the substratum; in landscape positions similar to those of the Tonkey soil
• The moderately well drained Alcona soils on knolls and ridges

Similar inclusions:
• Soils that are somewhat poorly drained
• Soils that have more sand in the profile
• Soils that have more clay in the profile

Use and Management

Land use: Dominant use—woodland; other use—pasture

Pasture

Major management concerns: Seasonal wetness, overgrazing
Management considerations:
• Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, plant competition
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
• Landing sites generally can be used only during the driest time of the year.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

Buildings

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 5W
Michigan soil management group: 3c-s

39B—Glennie loamy sand, moderately wet, 0 to 6 percent slopes

Setting

Landform: Ground moraines
Shape of areas: Irregular
Size of areas: 50 to 500 acres

Typical Profile

Organic mat:
0 to 2 inches—black, partially decomposed forest litter

Surface layer:
2 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown loamy sand

Subsoil:
7 to 11 inches—dark brown sandy loam
11 to 20 inches—strong brown loamy sand
20 to 40 inches—brown loamy sand and reddish brown loam
40 to 46 inches—reddish brown, mottled sandy clay loam and brown, mottled sandy loam
46 to 56 inches—dark reddish brown, mottled clay
56 to 85 inches—reddish brown sandy clay loam

Substratum:
85 to 99 inches—reddish brown sandy clay loam

Soil Properties and Qualities

Permeability: Moderately rapid in the loamy sand part; very slow in the loamy and clayey parts
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Perched at a depth of 3.5 to 4.5 feet from November through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and moderate in the lower part

Composition

Glennie and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The very poorly drained Lupton soils in depressions

Similar inclusions:
• Soils that are well drained

Use and Management

Land use: Dominant use—woodland; other uses—pasture, cropland, building sites

Cropland

Major management concerns: Soil blowing, water erosion, droughtiness
Management considerations:
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
• The water intake rate can be increased by growing cover crops, leaving crop residue on the surface, and regularly adding other organic material.
• Growing grasses and legumes in rotation can reduce nutrient losses, improve soil structure, and provide nitrogen for use by subsequent crops.
• Wetness may delay site preparation and planting in the spring.

Pasture

Major management concerns: Overgrazing
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, plant competition
Management considerations:
• Skidders should not be used during wet periods, when ruts form easily. Year-round logging roads require a gravel base.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.

• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave, shrink-swell, seasonal wetness
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Seasonal wetness, very slow permeability
Management considerations:
• Mounding or adding suitable fill material helps to raise the absorption field above the water table.
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
• Backfilling the trenches with porous material also helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: 5D
Michigan soil management group: 4/2a-f

39C—Glennie loamy sand, moderately wet, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on ground moraines
Shape of areas: Irregular
Size of areas: 10 to 250 acres

Typical Profile

Organic mat:
0 to 2 inches—black, partially decomposed forest litter

Surface layer:
2 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown loamy sand

Subsoil:
7 to 11 inches—dark brown sandy loam
11 to 20 inches—strong brown loamy sand
20 to 40 inches—brown loamy sand and reddish brown loam
40 to 46 inches—reddish brown, mottled sandy clay loam and brown, mottled sandy loam
46 to 56 inches—dark reddish brown, mottled clay
56 to 85 inches—reddish brown sandy clay loam

Substratum:
85 to 99 inches—reddish brown sandy clay loam

Soil Properties and Qualities

Permeability: Moderately rapid in the sandy part; very slow in the loamy and clayey parts
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Perched at a depth of 3.5 to 4.5 feet from November through May
Surface runoff: Slow
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and moderate in the lower part

Composition

Glennie and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Graycalm soils, which are sandy throughout; in landscape positions similar to those of the Glennie soil

Similar inclusions:
• Soils that are well drained

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Water erosion, soil blowing

Management considerations:
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.

Pasture

Major management concerns: Overgrazing
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, plant competition
Management considerations:
• Skidders should not be used during wet periods, when ruts form easily. Year-round logging roads require a gravel base.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave, seasonal wetness, shrink-swell, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Very slow permeability, seasonal wetness, slope
Management considerations:
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
• Backfilling the trenches with porous material also helps to overcome the restricted permeability.
• Mounding or adding suitable fill material helps to raise the absorption field above the water table.
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 5D
Michigan soil management group: 4/2a-f

40A—Sprinkler sandy loam, 0 to 3 percent slopes

Setting

Landform: Ground moraines
Shape of areas: Irregular
Size of areas: 10 to 150 acres

Typical Profile

Surface layer:
0 to 5 inches—very dark gray sandy loam

Subsurface layer:
5 to 13 inches—brown, mottled sandy loam

Subsoil:
13 to 28 inches—brown, mottled sandy loam and loam
28 to 35 inches—dark brown, mottled loam
35 to 44 inches—brown, mottled loam

Substratum:
44 to 60 inches—brown, mottled loam

Soil Properties and Qualities

Permeability: Moderate in the sandy loam part; moderately slow in the loam part
Available water capacity: Moderate
Drainage class: Somewhat poorly drained
Seasonal high water table: Perched at a depth of 0.5 foot to 1.5 feet from October through May
Surface runoff: Very slow

Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and moderate in the lower part

Composition

Sprinkler and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The moderately well drained Glennie soils in the higher positions on the landscape

Similar inclusions:
• Soils that have a surface layer of loamy sand

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Seasonal wetness, moderately slow permeability, soil blowing
Management considerations:
• Most adapted crops can be grown if an adequate drainage system is installed.
• Because of the moderately slow permeability, subsurface drains should be narrowly spaced.
• Nutrients in manure and fertilizer applications should not exceed the nutrient requirements of the plants.
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.

Pasture

Major management concerns: Overgrazing, seasonal wetness
Management considerations:
• Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, and plant competition
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Seasonal wetness, shrink-swell
Management considerations:
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields

Major management concerns: Seasonal wetness, moderately slow permeability
Management considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIw
Woodland ordination symbol: 3W
Michigan soil management group: 2.5b

41B—McGinn loamy sand, 0 to 6 percent slopes

Setting

Landform: Ground moraines
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Typical Profile

Organic mat:
0 to 1 inch—black, partially decomposed leaf litter

Surface layer:
1 to 2 inches—black loamy sand

Subsurface layer:
2 to 4 inches—light brownish gray loamy sand

Subsoil:
4 to 6 inches—strong brown loamy sand
6 to 16 inches—dark yellowish brown loamy sand
16 to 25 inches—grayish brown loamy sand and reddish brown sandy loam
25 to 35 inches—reddish brown sandy loam

Substratum:
35 to 80 inches—light reddish brown sandy loam

Soil Properties and Qualities

Permeability: Moderately rapid in the sandy part; moderate in the loamy part
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

McGinn and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Klacking soils, which contain less clay in the subsoil than the McGinn soil; in landscape positions similar to those of the McGinn soil

Similar inclusions:
• Soils that are moderately well drained
• Soils that have a surface layer of sandy loam

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Soil blowing, low organic matter content, nutrient loss
Management considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, and cover crops help to control soil blowing.
• Keeping crop residue on the surface, regularly adding other organic material, and applying a system of no-till planting increase the organic matter content.
• Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and can help to prevent ground-water pollution.

Pasture

Major management concerns: Overgrazing, erosion hazard
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: None

Buildings

Major management concerns: Cutbanks cave
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: None

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: 4S
Michigan soil management group: 4a

41C—McGinn loamy sand, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on ground moraines
Shape of areas: Irregular
Size of areas: 5 to 100 acres

Typical Profile

Organic mat:
0 to 1 inch—black, partially decomposed leaf litter

Surface layer:
1 to 2 inches—black loamy sand

Subsurface layer:
2 to 4 inches—light brownish gray loamy sand

Subsoil:
4 to 6 inches—strong brown loamy sand
6 to 16 inches—dark yellowish brown loamy sand
16 to 25 inches—grayish brown loamy sand and reddish brown sandy loam
25 to 35 inches—reddish brown sandy loam

Substratum:
35 to 80 inches—light reddish brown sandy loam

Soil Properties and Qualities

Permeability: Moderately rapid in the sandy part; moderate in the loamy part
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

McGinn and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Klacking soils, which contain less clay in the subsoil than the McGinn soil; in landscape positions similar to those of the McGinn soil

Similar inclusions:
• Soils that have a surface layer of sandy loam

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Soil blowing, low organic matter content, nutrient loss
Management considerations:
• Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, and cover crops help to control soil blowing.
• Keeping crop residue on the surface, regularly adding other organic material, and applying a system of no-till planting increase the organic matter content.
• Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and can help to prevent ground-water pollution.

Pasture

Major management concerns: Overgrazing, erosion hazard
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: None

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4S
Michigan soil management group: 4a

41D—McGinn loamy sand, 12 to 18 percent slopes

Setting

Landform: Ridges and knolls on ground moraines
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Organic mat:
0 to 1 inch—black, partially decomposed leaf litter

Surface layer:
1 to 2 inches—black loamy sand

Subsurface layer:
2 to 4 inches—light brownish gray loamy sand

Subsoil:
4 to 6 inches—strong brown loamy sand

6 to 16 inches—dark yellowish brown loamy sand
16 to 25 inches—grayish brown loamy sand and reddish brown sandy loam
25 to 35 inches—reddish brown sandy loam

Substratum:
35 to 80 inches—light reddish brown sandy loam

Soil Properties and Qualities

Permeability: Moderately rapid in the sandy part; moderate in the loamy part
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

McGinn and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Klacking soils, which contain less clay in the subsoil than the McGinn soil; in landscape positions similar to those of the McGinn soil

Similar inclusions:
• Soils that have a surface layer of sandy loam

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: None

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Land shaping may be necessary to develop a suitable building site.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 4S
Michigan soil management group: 4a

42A—Killmaster sandy loam, 0 to 3 percent slopes

Setting

Landform: Ground moraines and drumlins
Shape of areas: Irregular
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 8 inches—dark brown sandy loam

Subsurface layer
8 to 13 inches—brown, mottled sandy loam

Subsoil:
13 to 23 inches—brown, mottled loamy sand and dark brown, mottled sandy loam
23 to 32 inches—dark brown, mottled sandy loam

Substratum:
32 to 80 inches—brown, mottled sandy loam

Soil Properties and Qualities

Permeability: Moderate in the upper part; very slow in the substratum
Available water capacity: Moderate
Drainage class: Somewhat poorly drained
Seasonal high water table: Perched at a depth of 1 to 3 feet from October through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Killmaster and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The moderately well drained Hoist soils in the higher positions on the landscape

• The somewhat poorly drained Richter soils, which have stratified loamy sand and silt loam in the substratum; in landscape positions similar to those of the Killmaster soil
• The well drained Klacking soils in the higher positions on the landscape

Similar inclusions:
• Soils that have a surface layer of loamy sand

Use and Management

Land use: Dominant use—pasture; other uses—woodland, cropland, building sites

Cropland

Major management concerns: Seasonal wetness, low organic matter content, soil blowing
Management considerations:
• Most adapted crops can be grown if an adequate drainage system is installed.
• In some areas, improving drainage is difficult because adequate subsurface outlets are not available.
• Keeping crop residue on the surface, regularly adding other organic material, and applying a system of no-till planting increase the organic matter content.
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.

Pasture

Major management concerns: Seasonal wetness, overgrazing
Management considerations:
• Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, plant competition
Management considerations:
• Equipment should be used only when the soil is relatively dry or has an adequate snow cover.
• Skidders should not be used during wet periods, when ruts form easily.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• Carefully managed reforestation helps to control undesirable understory plants.
• Competing vegetation generally can be controlled by mechanical means.

Buildings

Major management concerns: Wetness
Management considerations:
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Wetness
Management considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: IIw
Woodland ordination symbol: 4W
Michigan soil management group: 3b

43—Wakeley mucky sand

Setting

Landform: Lake terraces
Slope: 0 to 1 percent
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 6 inches—black, mottled mucky sand

Substratum:
6 to 12 inches—gray sand
12 to 24 inches—grayish brown, mottled sand
24 to 29 inches—grayish brown, mottled, stratified sand and loamy sand
29 to 34 inches—pinkish gray, mottled clay
34 to 60 inches—pinkish gray, mottled, stratified clay and silty clay

Soil Properties and Qualities

Permeability: Rapid in the sandy part; very slow in the clayey part
Available water capacity: Low
Drainage class: Very poorly drained

Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Very slow or ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low in the upper part and high in the lower part

Composition

Wakeley and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Allendale soils in the higher positions on the landscape

Similar inclusions:
• Soils that have a surface layer of muck

Use and Management

Land use: Dominant use—woodland; other use—pasture

Pasture

Major management concerns: Seasonal wetness, overgrazing
Management considerations:
• Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, plant competition
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
• Landing sites generally can be used only during the driest time of the year.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

Buildings

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 3W
Michigan soil management group: 4/1c

44B—Bamfield fine sandy loam, moderately wet, 0 to 6 percent slopes

Setting

Landform: Ground moraines
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Organic mat:
0 to 1 inch—partially decomposed leaf litter

Surface layer:
1 to 6 inches—very dark grayish brown fine sandy loam

Subsoil:
6 to 11 inches—yellowish brown fine sandy loam
11 to 18 inches—pinkish gray fine sandy loam
18 to 21 inches—reddish brown clay loam and pinkish gray fine sandy loam
21 to 31 inches—reddish brown, mottled clay loam

Substratum:
31 to 60 inches—light reddish brown clay loam

Soil Properties and Qualities

Permeability: Very slow
Available water capacity: Moderate
Drainage class: Moderately well drained

Seasonal high water table: Perched at a depth of 1.5 to 3.0 feet from November through May
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and moderate in the lower part

Composition

Bamfield and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Kawkawlin soils in the lower positions on the landscape
• The poorly drained Lupton soils in depressions

Similar inclusions:
• Soils that have a surface layer of sandy loam

Use and Management

Land use: Dominant uses—cropland, woodland; other use—building sites

Cropland

Major management concerns: Water erosion, seasonal wetness, soil blowing
Management considerations:
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.
• Subsurface drains can reduce the wetness if a suitable outlet is available.
• Because of the very slow permeability, subsurface drains should be narrowly spaced.

Pasture

Major management concerns: Erosion hazard, seasonal wetness, compaction
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, plant competition, seasonal wetness, windthrow hazard
Management considerations:
• Skidders should not be used during wet periods, when ruts form easily. Year-round logging roads require a gravel base.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Shrink-swell, seasonal wetness
Management considerations:
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Very slow permeability, seasonal wetness
Management considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• Increasing the size of the absorption area and backfilling the trenches with porous material help to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 3L
Michigan soil management group: 3/2a

45B—Hoist sandy loam, moderately wet, 0 to 6 percent slopes

Setting

Landform: Till plains and drumlins
Shape of areas: Irregular
Size of areas: 50 to 300 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown sandy loam

Subsoil:
9 to 14 inches—yellowish brown sandy loam
14 to 21 inches—brown and reddish brown sandy loam
21 to 27 inches—reddish brown loam
27 to 49 inches—light reddish brown, mottled sandy loam

Substratum:
49 to 80 inches—light reddish brown sandy loam

Soil Properties and Qualities

Permeability: Moderately rapid in the upper part of the subsoil; moderately slow in the lower part of the subsoil; very slow in the substratum
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Perched at a depth of 2.5 to 3.5 feet from November through May
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Hoist and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Negwegon soils, which have more clay in the subsoil than the Hoist soil; in landscape positions similar to those of the Hoist soil
• The somewhat excessively drained Graycalm soils on breaks to drainageways

Similar inclusions:
• Soils that have a surface layer of loam

Use and Management

Land use: Dominant uses—woodland, cropland; other uses—pasture, building sites

Cropland

Major management concerns: Water erosion, soil blowing, tilth in the surface layer, seasonal wetness
Management considerations:
• A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.
• Crop residue management, green manure crops, applications of manure, cover crops, and conservation tillage help to maintain or improve tilth and increase the available water capacity and the organic matter content.
• Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
• Subsurface drains can reduce the wetness if a suitable outlet is available.

Pasture

Major management concerns: Overgrazing, seasonal wetness
Management considerations:
• Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes (fig. 9).

Woodland

Major management concerns: Equipment limitation, plant competition
Management considerations:
• Skidders should not be used during wet periods, when ruts form easily. Year-round logging roads require a gravel base.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Figure 9.—Grass-legume pasture in an area of Hoist sandy loam, moderately wet, 0 to 6 percent slopes. Proper management is needed to prevent surface compaction on this soil.

Buildings

Major management concerns: Cutbanks cave, seasonal wetness
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Seasonal wetness, very slow permeability
Management considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 3L
Michigan soil management group: 3a

45C—Hoist sandy loam, moderately wet, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on till plains and drumlins
Shape of areas: Irregular
Size of areas: 20 to 150 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown sandy loam

Subsoil:
9 to 14 inches—yellowish brown sandy loam
14 to 21 inches—brown and reddish brown sandy loam
21 to 27 inches—reddish brown loam
27 to 49 inches—light reddish brown, mottled sandy loam

Substratum:
49 to 80 inches—light reddish brown sandy loam

Soil Properties and Qualities

Permeability: Moderately rapid in the upper part of the subsoil; moderately slow in the lower part of the subsoil; very slow in the substratum
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Perched at a depth of 2.5 to 3.5 feet from November through May
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Hoist and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in the lower positions on the landscape
• The well drained Negwegon soils, which contain more clay than the Hoist soil; in landscape positions similar to those of the Hoist soil
• The somewhat excessively drained Graycalm soils on breaks to drainageways

Similar inclusions:
• Soils that have a surface layer of loam

Use and Management

Land use: Dominant uses—woodland, cropland; other uses—pasture, building sites

Cropland

Major management concerns: Water erosion, soil blowing, tilth in the surface layer
Management considerations:
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.
• Crop residue management, green manure crops, applications of manure, cover crops, and conservation tillage help to maintain or improve tilth and increase the available water capacity and the organic matter content.
• Wetness may delay site preparation and planting in the spring.

Pasture

Major management concerns: Erosion hazard
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, plant competition
Management considerations:
• Skidders should not be used during wet periods, when ruts form easily. Year-round logging roads require a gravel base.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Cutbanks cave, slope, seasonal wetness
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Some land grading may be needed.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Very slow permeability, seasonal wetness
Management considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.

• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 3L
Michigan soil management group: 3a

46—Ensley mucky sandy loam

Setting

Landform: Depressions on till plains and wave-cut platforms
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 80 acres

Typical Profile

Surface layer:
0 to 8 inches—black mucky sandy loam

Subsoil:
8 to 15 inches—grayish brown, mottled sandy loam
15 to 29 inches—light reddish brown, mottled sandy loam

Substratum:
29 to 42 inches—pinkish gray, mottled sandy loam
42 to 60 inches—gray sandy loam

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Very slow or ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Ensley and similar soils: 95 to 98 percent
Contrasting inclusions: 2 to 5 percent

Inclusions

Contrasting inclusions:
• The very poorly drained Leafriver soils, which have a sandy profile; in landscape positions similar to those of the Ensley soil

Similar inclusions:
• Soils that have a surface layer of muck

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, plant competition
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
• Landing sites generally can be used only during the driest time of the year.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

Buildings

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 3W
Michigan soil management group: 3c

53B—Negwegon silt loam, moderately wet, 2 to 6 percent slopes

Setting

Landform: Lake plains
Shape of areas: Irregular
Size of areas: 50 to 300 acres

Typical Profile

Surface layer:
0 to 8 inches—dark brown silt loam

Subsoil:
8 to 16 inches—reddish brown, mottled silty clay loam and brown, mottled silt loam
16 to 24 inches—reddish brown clay that has thin strata of yellowish brown silt loam
24 to 46 inches—reddish brown silty clay

Substratum:
46 to 60 inches—stratified brown silty clay loam and yellowish brown silt loam

Soil Properties and Qualities

Permeability: Very slow
Available water capacity: High
Drainage class: Moderately well drained
Seasonal high water table: Perched at a depth of 1 to 3 feet from November through May
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Slight
Shrink-swell potential: High

Composition

Negwegon and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The poorly drained Springport soils in depressions and drainageways

Similar inclusions:
• Soils that are well drained

Use and Management

Land use: Dominant uses—cropland, pasture; other uses—woodland, building sites

Cropland

Major management concerns: Erosion hazard, seasonal wetness, tilth in the surface layer, soil compaction, nutrient loss
Management considerations:
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
• A subsurface drainage system can lower the water table.
• Because of the very slow permeability, subsurface drains should be narrowly spaced.
• Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, permeability, and the rate of water infiltration.
• Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
• Crop rotations and the use of legumes may reduce the need for commercial fertilizer. Sod-based rotations significantly reduce dissolved and particulate nitrogen and phosphorus losses by minimizing runoff losses.

Pasture

Major management concerns: Erosion hazard, seasonal wetness, compaction
Management considerations:
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, plant competition
Management considerations:
• Because of the very slow permeability and the sticky and plastic subsoil, logging roads should be graveled and, in some areas, landings should be stabilized.
• Skidders should not be used during wet periods, when ruts form easily.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.

• Species preference can be managed by selective cutting.

Buildings

Major management concerns: Shrink-swell, seasonal wetness
Management considerations:
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Very slow permeability, seasonal wetness
Management considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• Increasing the size of the absorption area helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 3L
Michigan soil management group: 1a

53C—Negwegon silt loam, moderately wet, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on lake plains
Shape of areas: Irregular
Size of areas: 25 to 150 acres

Typical Profile

Surface layer:
0 to 8 inches—dark brown silt loam

Subsoil:
8 to 16 inches—reddish brown, mottled silty clay loam and brown, mottled silt loam
16 to 24 inches—reddish brown clay that has thin strata of yellowish brown silt loam
24 to 46 inches—reddish brown silty clay

Substratum:
46 to 60 inches—stratified brown silty clay loam and yellowish brown silt loam

Soil Properties and Qualities

Permeability: Very slow
Available water capacity: High
Drainage class: Moderately well drained
Seasonal high water table: Perched at a depth of 1 to 3 feet from November through May
Surface runoff: Rapid
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Slight
Shrink-swell potential: High

Composition

Negwegon and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The moderately well drained Alcona soils, which have coarser textures in the profile than the Negewegon soil; in the lower positions on the landscape

Similar inclusions:
• Soils that are well drained

Use and Management

Land use: Dominant uses—cropland, pasture; other uses—woodland, building sites

Cropland

Major management concerns: Erosion hazard, seasonal wetness, tilth in the surface layer, soil compaction, nutrient loss
Management considerations:
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
• Growing grasses and legumes for pasture or hay is effective in controlling erosion.
• Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, permeability, and the rate of water infiltration.
• Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
• Crop rotations and the use of legumes may reduce the need for commercial fertilizer. Sod-based rotations significantly reduce dissolved and particulate nitrogen and phosphorus losses by minimizing runoff losses.
• Wetness may delay site preparation and planting in the spring.

Pasture

Major management concerns: Erosion hazard, seasonal wetness, compaction
Management considerations:
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, plant competition
Management considerations:
• Because of the very slow permeability and the sticky and plastic subsoil, logging roads should be graveled and, in some areas, landings should be stabilized.
• Skidders should not be used during wet periods, when ruts form easily.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Species preference can be managed by selective cutting.

Buildings

Major management concerns: Shrink-swell, seasonal wetness
Management considerations:
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Very slow permeability, seasonal wetness
Management considerations:
• Increasing the size of the absorption area helps to compensate for the restricted permeability.
• Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 3L
Michigan soil management group: 1a

54A—Algonquin silt loam, 0 to 3 percent slopes

Setting

Landform: Lake plains
Shape of areas: Irregular
Size of areas: 5 to 400 acres

Typical Profile

Surface layer:
0 to 7 inches—dark brown, mottled silt loam

Subsoil:
7 to 11 inches—reddish brown, mottled silty clay
11 to 14 inches—reddish brown, mottled silty clay loam
14 to 29 inches—light reddish brown, mottled silty clay
29 to 60 inches—light reddish brown, mottled silty clay loam

Soil Properties and Qualities

Permeability: Very slow
Available water capacity: High
Drainage class: Somewhat poorly drained
Seasonal high water table: Perched at a depth of 0.5 foot to 1.5 feet from October through May
Surface runoff: Slow
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Slight
Shrink-swell potential: High

Composition

Algonquin and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The moderately well drained Negwegon soils in the higher positions on the landscape
• The somewhat poorly drained Allendale soils, which have sand or loamy sand in the surface layer and the upper part of the subsoil; on small ridges near the edges of the unit
• The moderately well drained Alcona soils in the higher positions on the landscape

Similar inclusions:
• Soils that have a thin surface layer of sandy loam

Use and Management

Land use: Dominant uses—cropland, pasture; other uses—woodland, building sites

Cropland

Major management concerns: Seasonal wetness, very slow permeability, soil compaction, tilth in the surface layer
Management considerations:
• Subsurface drains can reduce the wetness if a suitable outlet is available.
• Because of the very slow permeability, subsurface drains should be narrowly spaced.
• Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, permeability, and the rate of water infiltration.
• Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth (fig. 10).

Pasture

Major management concerns: Compaction, seasonal wetness
Management considerations:
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.
• Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, plant competition, seedling mortality
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• Because of the very slow permeability and the sticky and plastic subsoil, logging roads should be graveled and, in some areas, landings should be stabilized.
• Skidders should not be used during wet periods, when ruts form easily.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Carefully managed reforestation helps to control undesirable understory plants.

Buildings

Major management concerns: Shrink-swell, seasonal wetness
Management considerations:
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Seasonal wetness, very slow permeability
Management considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• Increasing the size of the absorption area helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: 6W
Michigan soil management group: 1b

55—Springport clay loam

Setting

Landform: Depressions on lake plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 50 to 150 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark gray clay loam

Subsoil:
8 to 12 inches—grayish brown, mottled clay
12 to 27 inches—reddish brown, mottled silty clay

Substratum:
27 to 60 inches—reddish brown, mottled silty clay

Soil Properties and Qualities

Permeability: Very slow

Figure 10.—Corn in an area of Algonquin silt loam, 0 to 3 percent slopes. Because of a relatively short growing season, most of the corn is used for silage.

Available water capacity: High
Drainage class: Poorly drained
Seasonal high water table: Perched 1 foot above to 1 foot below the surface from September through June
Surface runoff: Very slow or ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Slight
Shrink-swell potential: High

Composition

Springport and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The moderately well drained Negwegon soils on low knolls or ridges
• The somewhat poorly drained Algonquin soils in the slightly higher positions on the landscape

Similar inclusions:
• Soils that have a mucky surface layer

Use and Management

Land use: Dominant uses—woodland, pasture; other use—cropland

Cropland

Major management concerns: Seasonal wetness, tilth in the surface layer, soil compaction, very slow permeability, ponding
Management considerations:
• Shallow surface ditches help to remove surface water after heavy rains.
• Subsurface drains can reduce the wetness if a suitable outlet is available.

• Because of the very slow permeability, subsurface drains should be narrowly spaced.
• Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, permeability, and the rate of water infiltration.
• Applying a system of conservation tillage and deferring tillage when the soil is wet help to prevent the deterioration of tilth.

Pasture

Major management concerns: Seasonal wetness, compaction
Management considerations:
• Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.
• Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, plant competition
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• Because of the very slow permeability and the sticky and plastic subsoil, logging roads should be graveled and, in some areas, landings should be stabilized.
• Skidders should not be used during wet periods, when ruts form easily.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

Buildings

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding
Management considerations:
• Because of ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: 6W
Michigan soil management group: 1c

56B—Nester loam, moderately wet, 0 to 6 percent slopes

Setting

Landform: Till plains
Shape of areas: Irregular
Size of areas: 50 to 200 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loam

Subsoil:
9 to 14 inches—brown, mottled sandy loam and reddish brown, mottled clay loam
14 to 25 inches—reddish brown, mottled clay loam
25 to 40 inches—reddish brown clay loam

Substratum:
40 to 60 inches—light reddish brown clay loam

Soil Properties and Qualities

Permeability: Slow
Available water capacity: High
Drainage class: Moderately well drained
Seasonal high water table: Perched at a depth of 2.5 to 5.0 feet from November through May
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Slight
Shrink-swell potential: Moderate

Composition

Nester and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained, strongly sloping Nester soils on breaks to drainageways

Similar inclusions:
• Soils that do not have mottles in the subsoil

Use and Management

Land use: Dominant uses—cropland, pasture; other uses—woodland, building sites

Cropland

Major management concerns: Erosion hazard, tilth in the surface layer, seasonal wetness, nutrient loss
Management considerations:
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion (fig. 11).
• Subsurface drains can reduce the wetness if a suitable outlet is available.
• Because of the slow permeability, subsurface drains should be narrowly spaced.
• Crop rotations and the use of legumes may reduce the need for commercial fertilizer. Sod-based rotations significantly reduce dissolved and particulate nitrogen and phosphorus losses by minimizing runoff losses.
• Minimizing tillage and tilling at the proper soil moisture content help to maintain good tilth.

Pasture

Major management concerns: Erosion hazard, seasonal wetness, compaction
Management considerations:
• Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, plant competition
Management considerations:
• Skidders should not be used during wet periods, when ruts form easily. Year-round logging roads require a gravel base.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Seasonal wetness, shrink-swell
Management considerations:
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields

Major management concerns: Seasonal wetness, slow permeability
Management considerations:
• Mounding or adding suitable fill material helps to raise the absorption field above the water table.
• Backfilling the trenches with porous material and increasing the size of the absorption area help to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 3L
Michigan soil management group: 1.5a

56C—Nester loam, moderately wet, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on till plains and moraines
Shape of areas: Irregular
Size of areas: 25 to 100 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loam

Subsoil:
9 to 14 inches—brown, mottled sandy loam and reddish brown, mottled clay loam
14 to 25 inches—reddish brown, mottled clay loam
25 to 40 inches—reddish brown clay loam

Substratum:
40 to 60 inches—light reddish brown clay loam

Soil Properties and Qualities

Permeability: Slow
Available water capacity: High
Drainage class: Moderately well drained
Seasonal high water table: Perched at a depth of 2.5 to 5.0 feet from November through May
Surface runoff: Medium
Flooding: None

Figure 11.—A grassed waterway and conservation tillage in an area of Nester loam, moderately wet, 0 to 6 percent slopes.

Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Slight
Shrink-swell potential: Moderate

Composition

Nester and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Nester soils on strongly sloping breaks to drainageways
- The somewhat poorly drained Kawkawlin soils in depressions

Similar inclusions:
- Soils that do not have mottles in the subsoil
- Soils that have a surface layer of sandy loam

Use and Management

Land use: Dominant uses—woodland, pasture; other uses—cropland, building sites

Cropland

Major management concerns: Erosion hazard, tilth in the surface layer, seasonal wetness, nutrient loss
Management considerations:
- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
- Minimizing tillage and tilling at the proper soil moisture content help to maintain good tilth.
- Wetness may delay site preparation and planting in the spring.
- Crop rotations and the use of legumes may reduce the need for commercial fertilizer. Sod-based

rotations significantly reduce dissolved and particulate nitrogen and phosphorus losses by minimizing runoff losses.

Pasture

Major management concerns: Erosion hazard, seasonal wetness, compaction
Management considerations:
• Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, plant competition
Management considerations:
• Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
• Skidders should not be used during wet periods, when ruts form easily. Year-round logging roads require a gravel base.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Seasonal wetness, shrink-swell, slope
Management considerations:
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Seasonal wetness, slow permeability, slope
Management considerations:
• Mounding or adding suitable fill material helps to raise the absorption field above the water table.
• Backfilling the trenches with porous material and increasing the size of the absorption area help to overcome the restricted permeability.
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 3L
Michigan soil management group: 1.5a

57B—Kawkawlin loam, 1 to 4 percent slopes

Setting

Landform: Till plains
Shape of areas: Irregular
Size of areas: 5 to 150 acres

Typical Profile

Surface layer:
0 to 10 inches—very dark grayish brown loam

Subsoil:
10 to 13 inches—dark brown, mottled clay loam and brown, mottled loam
13 to 30 inches—strong brown, mottled clay loam

Substratum:
30 to 60 inches—reddish brown, mottled clay loam

Soil Properties and Qualities

Permeability: Slow
Available water capacity: High
Drainage class: Somewhat poorly drained
Depth to the water table: 1 to 2 feet from October through May
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Slight
Shrink-swell potential: Moderate

Composition

Kawkawlin and similar soils: About 95 percent
Contrasting inclusions: About 5 percent

Inclusions

Contrasting inclusions:
• The poorly drained Tonkey soils in depressions
• The well drained Nester soils in the higher positions on the landscape

Similar inclusions:
• Soils that have a surface layer of loamy sand

Use and Management

Land use: Dominant use—cropland; other uses—woodland, pasture, building sites

Cropland

Major management concerns: Erosion hazard, seasonal wetness, tilth in the surface layer, nutrient loss
Management considerations:
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
• Subsurface drains can reduce the wetness if a suitable outlet is available.
• Shallow surface ditches help to remove surface water after heavy rains.
• Crop residue management, green manure crops, applications of manure, cover crops, and conservation tillage help to maintain or improve tilth and increase the available water capacity and the organic matter content.
• Crop rotations and the use of legumes may reduce the need for commercial fertilizer. Sod-based rotations significantly reduce dissolved and particulate nitrogen and phosphorus losses by minimizing runoff losses.

Pasture

Major management concerns: Seasonal wetness, overgrazing, compaction
Management considerations:
• Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants.
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, plant competition
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• Skidders should not be used during wet periods, when ruts form easily.
• Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Carefully managed reforestation helps to control undesirable understory plants.

Buildings

Major management concerns: Seasonal wetness
Management considerations:
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Seasonal wetness, slow permeability
Management considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 3W
Michigan soil management group: 1.5b

59B—Algonquin-Springport complex, 0 to 6 percent slopes

Setting

Landform: Algonquin—low knolls; Springport—depressions on lake plains
Shape of areas: Irregular
Size of areas: 50 to 300 acres

Typical Profile

Algonquin

Surface layer:
0 to 7 inches—dark brown, mottled silt loam

Subsoil:
7 to 11 inches—reddish brown, mottled silty clay
11 to 14 inches—reddish brown, mottled silty clay loam

14 to 29 inches—light reddish brown, mottled silty clay
29 to 60 inches—light reddish brown, mottled silty clay loam

Springport

Surface layer:
0 to 8 inches—very dark gray clay loam

Subsoil:
8 to 12 inches—grayish brown, mottled clay
12 to 27 inches—reddish brown, mottled silty clay

Substratum:
27 to 60 inches—reddish brown, mottled silty clay

Soil Properties and Qualities

Permeability: Very slow
Available water capacity: High
Drainage class: Algonquin—somewhat poorly drained; Springport—poorly drained
Seasonal high water table: Algonquin—perched at a depth of 0.5 foot to 1.5 feet from October through May; Springport—perched 1.0 foot above to 1.0 foot below the surface from September through June
Surface runoff: Algonquin—slow or medium; Springport—very slow or ponded
Flooding: None
Organic matter content: Algonquin—moderate; Springport—high
Hazard of water erosion: Algonquin—moderate; Springport—slight
Hazard of soil blowing: Slight
Shrink-swell potential: High

Composition

Algonquin and similar soils: 55 to 65 percent
Springport and similar soils: 30 to 40 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Allendale soils, which have a sandy surface layer and subsoil; in landscape positions similar to those of the Algonquin soil
• The very poorly drained Wakeley soils, which have a sandy surface layer and subsoil; in landscape positions similar to those of the Springport soil

Similar inclusions:
• Soils that have a mucky surface layer

Use and Management

Land use: Dominant uses—woodland, pasture; other uses—cropland, building sites

Cropland

Major management concerns: Algonquin—seasonal wetness, very slow permeability, compaction, tilth in the surface layer, erosion hazard; Springport—seasonal wetness, very slow permeability, compaction, tilth in the surface layer, ponding
Management considerations:
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
• Both surface and subsurface drainage systems are needed to reduce the wetness.
• In some areas, improving drainage is difficult because adequate subsurface outlets are not available.
• Because of the very slow permeability, subsurface drains should be narrowly spaced.
• Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, permeability, and the rate of water infiltration.
• Minimizing tillage and tilling at the proper soil moisture content help to maintain good tilth.

Pasture

Major management concerns: Seasonal wetness, compaction
Management considerations:
• Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.
• Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, plant competition
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• Because of the very slow permeability and the

sticky and plastic subsoil, logging roads should be graveled and, in some areas, landings should be stabilized.
• Skidders should not be used during wet periods, when ruts form easily.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Algonquin—shrink-swell, seasonal wetness; Springport—ponding
Management considerations:
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• A surface or subsurface drainage system helps to lower the water table.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Because of ponding, Springport soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Algonquin—seasonal wetness, very slow permeability; Springport—ponding
Management considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• Increasing the size of the absorption area helps to compensate for the very slow permeability.
• Because of ponding, the Springport soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: Algonquin—6W; Springport—6W
Michigan soil management group: Algonquin—1b; Springport—1c

60D—Glennie loamy sand, 12 to 18 percent slopes

Setting

Landform: Ridges and knolls on ground moraines
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Typical Profile

Organic mat:
0 to 2 inches—black, partially decomposed forest litter

Surface layer:
2 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown loamy sand

Subsoil:
7 to 11 inches—dark brown sandy loam
11 to 20 inches—strong brown loamy sand
20 to 40 inches—brown loamy sand and reddish brown loam
40 to 46 inches—reddish brown sandy clay loam and brown sandy loam
46 to 56 inches—dark reddish brown clay
56 to 85 inches—reddish brown sandy clay loam

Substratum:
85 to 99 inches—dark reddish brown sandy clay loam

Soil Properties and Qualities

Permeability: Moderately rapid in the sandy part; very slow in the loamy and clayey parts
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and moderate in the lower part

Composition

Glennie and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Graycalm soils, which have a sandy profile; in landscape positions similar to those of the Glennie soil
• The well drained Bamfield soils, which contain more clay than the Glennie soil; in landscape positions similar to those of the Glennie soil

Similar inclusions:
• Soils that are moderately well drained

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: Equipment limitation, windthrow hazard, plant competition
Management considerations:
• Skidders should not be used during wet periods, when ruts form easily. Year-round logging roads require a gravel base.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave, slope, shrink-swell
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Land shaping may be necessary to develop a suitable building site.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields

Major management concerns: Very slow permeability, slope
Management considerations:
• Increasing the size of the absorption area helps to compensate for the restricted permeability.
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 5D
Michigan soil management group: 4/2a-f

60E—Glennie loamy sand, 18 to 35 percent slopes

Setting

Landform: Ridges and knolls on ground moraines
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Organic mat:
0 to 2 inches—black, partially decomposed forest litter

Surface layer:
2 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown loamy sand

Subsoil:
7 to 11 inches—dark brown sandy loam
11 to 20 inches—strong brown loamy sand
20 to 40 inches—brown loamy sand and reddish brown loam
40 to 46 inches—reddish brown sandy clay loam and brown sandy loam
46 to 56 inches—dark reddish brown clay
56 to 85 inches—reddish brown sandy clay loam

Substratum:
85 to 99 inches—dark reddish brown sandy clay loam

Soil Properties and Qualities

Permeability: Moderately rapid in the sandy part; very slow in the loamy and clayey parts
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and moderate in the lower part

Composition

Glennie and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Graycalm soils, which have a sandy profile; in landscape positions similar to those of the Glennie soil

• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in landscape positions similar to those of the Glennie soil

Similar inclusions:
• Soils that are moderately well drained

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Erosion hazard, equipment limitation, windthrow hazard, plant competition, slope
Management considerations:
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Slope, cutbanks cave, shrink-swell
Management considerations:
• Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 5R
Michigan soil management group: 4/2a-f

61C—Manistee loamy sand, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on lake plains and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 4 inches—black loamy sand

Subsurface layer:
4 to 6 inches—pinkish gray loamy sand

Subsoil:
6 to 24 inches—strong brown loamy sand
24 to 27 inches—reddish brown clay and pinkish gray sandy loam
27 to 50 inches—reddish brown clay

Substratum:
50 to 60 inches—reddish brown clay

Soil Properties and Qualities

Permeability: Rapid in the sandy part; very slow in the clayey part
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and high in the lower part

Composition

Manistee and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The moderately well drained Alcona soils in the lower positions on the landscape
• The moderately well drained Hoist soils, which have a substratum of sandy loam; in the lower positions on the landscape

Similar inclusions:
• Soils that have thicker sandy layers

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Soil blowing, water erosion, nutrient loss
Management considerations:
• Soil blowing can be controlled by windbreaks, a system of conservation tillage that leaves all or part of the crop residue on the surface, stripcropping, or a combination of these. Maintaining a permanent plant cover also helps to control soil blowing.
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
• Timing fertilizer applications so that they meet the nutrient needs of the crop, using split fertilizer applications, and applying fertilizer in bands may reduce the risk of nutrient leaching.

Pasture

Major management concerns: Erosion hazard
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: None

Buildings

Major management concerns: Cutbanks cave, shrink-swell, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Very slow permeability, poor filtering capacity
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Filling or mounding with suitable material helps to raise the absorption field and increases the thickness of the filtering material.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 3A
Michigan soil management group: 4/1a

61D—Manistee loamy sand, 12 to 18 percent slopes

Setting

Landform: Ridges on lake plains
Shape of areas: Irregular
Size of areas: 10 to 80 acres

Typical Profile

Surface layer:
0 to 4 inches—black loamy sand

Subsurface layer:
4 to 6 inches—pinkish gray loamy sand

Subsoil:
6 to 24 inches—strong brown loamy sand
24 to 27 inches—reddish brown clay and pinkish gray sandy loam
27 to 50 inches—reddish brown clay

Substratum:
50 to 60 inches—reddish brown clay

Soil Properties and Qualities

Permeability: Rapid in the sandy part; very slow in the clayey part
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and high in the lower part

Composition

Manistee and similar soils: 95 to 98 percent
Contrasting inclusions: 2 to 5 percent

Inclusions

Contrasting inclusions:
• The well drained Hoist soils, which have a

substratum of sandy loam; in landscape positions similar to those of the Manistee soil

Similar inclusions:
• Soils that have thicker sandy layers

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: None

Buildings

Major management concerns: Slope, cutbanks cave, shrink-swell
Management considerations:
• Land shaping may be necessary to develop a suitable building site.
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields

Major management concerns: Slope, poor filtering capacity, very slow permeability
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.
• Filling or mounding with suitable material helps to raise the absorption field and increases the thickness of the filtering material.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 3A
Michigan soil management group: 4/1a

61F—Manistee loamy sand, 25 to 45 percent slopes

Setting

Landform: Escarpments on lake plains
Shape of areas: Elongated
Size of areas: 5 to 40 acres

Typical Profile

Surface layer:
0 to 4 inches—black loamy sand

Subsurface layer:
4 to 6 inches—pinkish gray loamy sand

Subsoil:
6 to 24 inches—strong brown loamy sand
24 to 27 inches—reddish brown clay and pinkish gray sandy loam
27 to 50 inches—reddish brown clay

Substratum:
50 to 60 inches—reddish brown clay

Soil Properties and Qualities

Permeability: Rapid in the sandy part; very slow in the clayey part
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and high in the lower part

Composition

Manistee and similar soils: 95 to 98 percent
Contrasting inclusions: 2 to 5 percent

Inclusions

Contrasting inclusions:
• The well drained Negwegon soils, which have more clay in the upper layers than the Manistee soil; in landscape positions similar to those of the Manistee soil

Similar inclusions:
• Soils that have thicker sandy layers

Use and Management

Land use: Woodland

Woodland

Major management concerns: Equipment hazard, erosion hazard, plant competition
Management considerations:
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.

• The grade should be kept as low as possible.
• In the steepest areas, cable yarding systems are generally safer than other logging methods and result in less surface disturbance.
• Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Carefully managed reforestation helps to control undesirable understory plants.

Buildings

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 3R
Michigan soil management group: 4/1a

62A—Allendale loamy sand, 0 to 3 percent slopes

Setting

Landform: Lake terraces
Shape of areas: Irregular
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 11 inches—very dark grayish brown loamy sand

Subsurface layer:
11 to 13 inches—pale brown, mottled sand

Subsoil:
13 to 20 inches—dark brown, mottled sand
20 to 22 inches—yellowish brown, mottled sand
22 to 25 inches—reddish brown, mottled sandy loam
25 to 60 inches—reddish brown, mottled silty clay

Soil Properties and Qualities

Permeability: Rapid in the sandy part; very slow in the clayey part
Available water capacity: Moderate
Drainage class: Somewhat poorly drained
Seasonal high water table: Perched at a depth of 0.5 foot to 1.5 feet from October through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and high in the lower part

Composition

Allendale and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Algonquin soils, which contain more clay in the surface layer and subsoil than the Allendale soil; in landscape positions similar to those of the Allendale soil
• The very poorly drained Wakeley soils in drainageways

Similar inclusions:
• Soils that have a silty or loamy substratum

Use and Management

Land use: Dominant uses—woodland, cropland; other uses—pasture, building sites

Cropland

Major management concerns: Seasonal wetness, soil blowing, nutrient loss, low organic matter content
Management considerations:
• Subsurface drains can reduce the wetness if a suitable outlet is available.
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.
• Nutrients in manure and fertilizer applications should not exceed the nutrient requirements of the plants.
• Including green manure crops in the cropping sequence, using no-till planting, and managing crop residue increase the organic matter content.

Pasture

Major management concerns: Overgrazing, seasonal wetness
Management considerations:
• Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants.

Woodland

Major management concerns: Seasonal wetness, equipment limitation, windthrow hazard, plant competition
Management considerations:
• Equipment can be used only during dry summer months and during periods in winter when the snow cover is adequate or the soil is frozen.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• Special harvest methods may be needed to control undesirable plants.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
• Trees that can withstand seasonal wetness should be selected for planting.

Buildings

Major management concerns: Seasonal wetness, shrink-swell, cutbanks cave
Management considerations:
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Seasonal wetness, very slow permeability, poor filtering capacity
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Mounding or adding suitable fill material helps to raise the absorption field above the water table and increases the thickness of the filtering material.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: 4W
Michigan soil management group: 4/1b

63C—Bamfield fine sandy loam, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on ground moraines
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Organic mat:
0 to 1 inch—partially decomposed leaf litter

Surface layer:
1 to 6 inches—very dark grayish brown fine sandy loam

Subsoil:
6 to 11 inches—yellowish brown fine sandy loam
11 to 18 inches—pinkish gray fine sandy loam
18 to 21 inches—reddish brown clay loam and pinkish gray fine sandy loam
21 to 31 inches—reddish brown clay loam

Substratum:
31 to 60 inches—light reddish brown clay loam

Soil Properties and Qualities

Permeability: Moderately rapid in the fine sandy loam part; very slow in the clay loam part
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and moderate in the lower part

Composition

Bamfield and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in landscape positions similar to those of the Bamfield soil

Similar inclusions:
• Soils that have a surface layer of loamy sand

Use and Management

Land use: Dominant uses—woodland, pasture; other uses—cropland, building sites

Cropland

Major management concerns: Water erosion, soil blowing
Management considerations:
• A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
• Growing grasses and legumes for pasture or hay is effective in controlling erosion.
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.

Pasture

Major management concerns: Erosion hazard, compaction
Management considerations:
• Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, plant competition
Management considerations:
• Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
• Skidders should not be used during wet periods, when ruts form easily.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Shrink-swell, slope
Management considerations:
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Very slow permeability
Management considerations:
• Increasing the size of the absorption area and backfilling the trenches with porous material help to overcome the restricted permeability.
• Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 3L
Michigan soil management group: 1.5a

63D—Bamfield fine sandy loam, 12 to 18 percent slopes

Setting

Landform: Ridges and knolls on ground moraines and disintegration moraines
Shape of areas: Irregular
Size of areas: 5 to 75 acres

Typical Profile

Organic mat:
0 to 1 inch—partially decomposed leaf litter

Surface layer:
1 to 6 inches—very dark grayish brown fine sandy loam

Subsoil:
6 to 11 inches—yellowish brown fine sandy loam
11 to 18 inches—pinkish gray fine sandy loam
18 to 21 inches—reddish brown clay loam and pinkish gray fine sandy loam
21 to 31 inches—reddish brown clay loam

Substratum:
31 to 60 inches—light reddish brown clay loam

Soil Properties and Qualities

Permeability: Moderately rapid in the fine sandy loam part; very slow in the clay loam part
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Rapid
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and moderate in the lower part

Composition

Bamfield and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Nester soils, which contain more clay in the upper part of the subsoil than the Bamfield soil; in landscape positions similar to those of the Bamfield soil
• The poorly drained Lupton soils in closed depressions

Similar inclusions:
• Soils that are moderately well drained
• Soils that have a surface layer of loam

Use and Management

Land use: Dominant use—woodland; other use—pasture

Pasture

Major management concerns: Erosion hazard, compaction
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, plant competition
Management considerations:
• Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
• Skidders should not be used during wet periods, when ruts form easily.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Slope, shrink-swell
Management considerations:
• Land shaping may be necessary to develop a suitable building site.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields

Major management concerns: Slope, very slow permeability
Management considerations:
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.
• Increasing the size of the absorption area and backfilling the trenches with porous material help to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 3L
Michigan soil management group: 1.5a

63F—Bamfield fine sandy loam, 25 to 45 percent slopes

Setting

Landform: Ridges and knolls on disintegration moraines
Shape of areas: Irregular
Size of areas: 5 to 40 acres

Typical Profile

Organic mat:
0 to 1 inch—partially decomposed leaf litter

Surface layer:
1 to 6 inches—very dark grayish brown fine sandy loam

Subsoil:
6 to 11 inches—yellowish brown fine sandy loam
11 to 18 inches—pinkish gray fine sandy loam
18 to 21 inches—reddish brown clay loam and pinkish gray fine sandy loam
21 to 31 inches—reddish brown clay loam

Substratum:
31 to 60 inches—light reddish brown clay loam

Soil Properties and Qualities

Permeability: Moderately rapid in the fine sandy loam part; very slow in the clay loam part
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Very rapid
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and moderate in the lower part

Composition

Bamfield and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Sprinkler soils in drainageways

Similar inclusions:
• Soils that have a sandy surface layer

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, erosion hazard, plant competition
Management considerations:
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The grade should be kept as low as possible.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• In the steepest areas, cable yarding systems are generally safer than other logging methods and result in less surface disturbance.
• Because of the erosion hazard, skid roads and skid trails should be established on the contour and water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 3R
Michigan soil management group: 1.5a

66D—Alcona loamy very fine sand, 12 to 18 percent slopes

Setting

Landform: Ridges and knolls on lake terraces and deltas
Shape of areas: Irregular
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 1 inch—black loamy very fine sand

Subsurface layer:
1 to 3 inches—grayish brown loamy very fine sand

Subsoil:
3 to 8 inches—dark brown loamy very fine sand
8 to 12 inches—yellowish brown loamy very fine sand
12 to 16 inches—brown loamy very fine sand
16 to 21 inches—brown loam and light yellowish brown very fine sandy loam
21 to 41 inches—dark brown loam

Substratum:
41 to 60 inches—light yellowish brown loamy very fine sand

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Alcona and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The excessively drained Zimmerman soils in landscape positions similar to those of the Alcona soil

Similar inclusions:
• Soils that are moderately well drained

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, plant competition
Management considerations:
• Skidders should not be used during wet periods, when ruts form easily. Year-round logging roads require a gravel base.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Land shaping may be necessary to develop a suitable building site.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 3L
Michigan soil management group: 3a-s

66E—Alcona loamy very fine sand, 18 to 35 percent slopes

Setting

Landform: Escarpments on lake terraces and deltas
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 1 inch—black loamy very fine sand

Subsurface layer:
1 to 3 inches—grayish brown loamy very fine sand

Subsoil:
3 to 8 inches—dark brown loamy very fine sand
8 to 12 inches—yellowish brown loamy very fine sand
12 to 16 inches—brown loamy very fine sand
16 to 21 inches—brown loam and light yellowish brown very fine sandy loam
21 to 41 inches—dark brown loam

Substratum:
41 to 60 inches—light yellowish brown loamy very fine sand

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Rapid
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Alcona and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The excessively drained Zimmerman soils in landscape positions similar to those of the Alcona soil

Similar inclusions:
• Soils that are moderately well drained

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, erosion hazard, plant competition, slope
Management considerations:
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The grade should be kept as low as possible.
• Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Slope, cutbanks cave
Management considerations:
• Because of the slope, this soil is poorly suited to building site development unless extensive land shaping is applied.
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 3R
Michigan soil management group: 3a-s

68—Rondeau muck

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent
Shape of areas: Irregular
Size of areas: 5 to 25 acres

Typical Profile

Surface layer:
0 to 6 inches—black muck

Subsoil:
6 to 19 inches—dark reddish brown muck

Substratum:
19 to 60 inches—light gray marl

Soil Properties and Qualities

Permeability: Moderately slow to moderately rapid in the muck part; slow or very slow in the marl part
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate

Composition

Rondeau and similar soils: 100 percent

Inclusions

Similar inclusions:
• Soils that have a mucky surface layer less than 16 inches thick

Use and Management

Land use: Dominant use—wetland wildlife habitat

Buildings

Major management concerns: Ponding, low strength
Management considerations:
• Because of ponding and low strength, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding, low strength
Management considerations:
• Because of ponding and low strength, this soil is

generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIw
Woodland ordination symbol: None assigned
Michigan soil management group: M/mc

69—Loxley peat

Setting

Landform: Closed depressions on lake plains and outwash plains
Slope: 0 to 1 percent
Shape of areas: Oval
Size of areas: 5 to 200 acres

Typical Profile

Surface layer:
0 to 18 inches—dark brown peat

Substratum:
18 to 28 inches—dark brown muck
28 to 60 inches—black muck

Soil Properties and Qualities

Permeability: Moderately slow to moderately rapid
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Slight

Composition

Loxley and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
• The very poorly drained Kinross soils, which have a thin organic surface layer; near the edges of the unit

Similar inclusions:
• Soils that have a sandy substratum

Use and Management

Land use: Dominant use—wetland wildlife habitat (fig. 12)

Buildings

Major management concerns: Ponding, low strength
Management considerations:
• Because of ponding and low strength, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding, low strength
Management considerations:
• Because of ponding and low strength, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIw
Woodland ordination symbol: 2W
Michigan soil management group: Mc-a

70—Lupton muck

Setting

Landform: Depressions on lake plains, outwash plains, and till plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Typical Profile

Surface layer:
0 to 5 inches—black muck

Substratum:
5 to 60 inches—dark reddish brown muck

Soil Properties and Qualities

Permeability: Moderately slow to moderately rapid
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate

Composition

Lupton and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
• The very poorly drained Leafriver soils, which have

Figure 12.—Leatherleaf and blueberries are the major vegetation in areas of Loxley peat. A few tamarack and black spruce also grow on this soil, which is used mainly as habitat for wetland wildlife.

less than 16 inches of organic material over mineral soil material; near the edges of the unit
• The very poorly drained Tawas soils, which have less than 51 inches of muck over mineral soil material; near the edges of the unit

Similar inclusions:
• Soils having organic layers in the lower part of the substratum that are less decomposed

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, plant competition, seedling mortality, windthrow hazard
Management considerations:
• Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Selective cutting or cutting in strips and leaving desirable seed trees along the edge of the openings can enhance natural regeneration.

Buildings

Major management concerns: Ponding, low strength
Management considerations:
• Because of ponding and low strength, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding, low strength

Management considerations:
• Because of ponding and low strength, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIw
Woodland ordination symbol: 2W
Michigan soil management group: Mc

71—Tawas muck

Setting

Landform: Depressions on lake terraces
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 300 acres

Typical Profile

Surface layer:
0 to 5 inches—black muck

Subsoil:
5 to 17 inches—black muck

Substratum:
17 to 60 inches—brown and dark brown sand

Soil Properties and Qualities

Permeability: Moderately slow to moderately rapid in the muck part; rapid in the sand part
Available water capacity: High
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the substratum

Composition

Tawas and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
• The very poorly drained Kinross soils, which have less than 7 inches of muck in the surface layer; near the edges of the unit
• The very poorly drained Leafriver soils, which have less than 16 inches of muck in the surface layer; near the edges of the unit
• The somewhat poorly drained Au Gres soils on low ridges

Similar inclusions:
• Soils that have thin loamy layers in the substratum

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, plant competition, seedling mortality, windthrow hazard
Management considerations:
• Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Selective cutting or cutting in strips and leaving desirable seed trees along the edge of the openings can enhance natural regeneration.
• Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

Buildings

Major management concerns: Ponding, low strength
Management considerations:
• Because of ponding and low strength, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding, low strength
Management considerations:
• Because of ponding and low strength, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIw
Woodland ordination symbol: 5W
Michigan soil management group: M/4c

72—Dorval muck

Setting

Landform: Depressions on lake plains
Slope: 0 to 2 percent

Shape of areas: Irregular
Size of areas: 5 to 150 acres

Typical Profile

Surface layer:
0 to 6 inches—black muck

Subsoil:
6 to 27 inches—black muck

Substratum:
27 to 60 inches—brown, mottled silty clay

Soil Properties and Qualities

Permeability: Moderately slow to moderately rapid in the muck part; very slow in the silty clay part
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: Perched 1 foot above to 1 foot below the surface from October through May
Surface runoff: Ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: High in the substratum

Composition

Dorval and similar soils: About 95 percent
Contrasting inclusions: About 5 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Algonquin soils on low knolls
• The very poorly drained Lupton soils, which have more than 51 inches of muck; in landscape positions similar to those of the Dorval soil

Similar inclusions:
• Soils that have a thin layer of sand above the clayey substratum

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, plant competition
Management considerations:
• Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Selective cutting or cutting in strips and leaving desirable seed trees along the edge of the openings can enhance natural regeneration.
• Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

Buildings

Major management concerns: Ponding, low strength
Management considerations:
• Because of ponding and low strength, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding, low strength
Management considerations:
• Because of ponding and low strength, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 2W
Michigan soil management group: M/1c

73—Markey muck

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent
Shape of areas: Irregular
Size of areas: 100 to 200 acres

Typical Profile

Surface layer:
0 to 4 inches—black muck

Subsoil:
4 to 28 inches—very dark brown muck

Substratum:
28 to 60 inches—grayish brown sand

Soil Properties and Qualities

Permeability: Moderately slow to moderately rapid in the muck part; rapid in the sand part
Available water capacity: High
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot

below the surface from October through May
Surface runoff: Ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Markey and similar soils: 100 percent

Inclusions

Similar inclusions:
• Soils that have a thinner surface layer of muck

Use and Management

Land use: Dominant use—wetland wildlife habitat

Buildings

Major management concerns: Ponding, low strength
Management considerations:
• Because of ponding and low strength, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding, low strength
Management considerations:
• Because of ponding and low strength, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: None assigned
Michigan soil management group: M/4c

74C2—Negwegon silty clay loam, moderately wet, 6 to 12 percent slopes, eroded

Setting

Landform: Ridges and knolls on lake plains
Distinctive landscape features: Eroded surface
Shape of areas: Irregular
Size of areas: 25 to 150 acres

Typical Profile

Surface layer:
0 to 8 inches—dark brown silty clay loam and reddish brown silty clay

Subsoil:
8 to 10 inches—reddish brown, mottled silty clay loam and silty clay
10 to 40 inches—reddish brown silty clay

Substratum:
40 to 60 inches—stratified reddish brown silty clay loam and yellowish brown silt loam

Soil Properties and Qualities

Permeability: Very slow
Available water capacity: High
Drainage class: Moderately well drained
Seasonal high water table: Perched at a depth of 1 to 3 feet from November through May
Surface runoff: Rapid
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Slight
Shrink-swell potential: High

Composition

Negwegon and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Alcona soils in the lower positions on the landscape

Similar inclusions:
• Soils that are well drained
• Soils that have a darker surface layer

Use and Management

Land use: Dominant uses—cropland, pasture

Cropland

Major management concerns: Erosion hazard, seasonal wetness, low organic matter content, tilth in the surface layer, soil compaction, nutrient loss
Management considerations:
• Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
• Growing grasses and legumes for pasture or hay is effective in controlling erosion.
• Wetness may delay site preparation and planting in the spring.
• Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, permeability, and the rate of water infiltration.
• Minimizing tillage and tilling and harvesting at the

proper soil moisture content help to prevent excessive compaction and maintain tilth.
• Crop rotations and the use of legumes may reduce the need for commercial fertilizer. Sod-based rotations significantly reduce dissolved and particulate nitrogen and phosphorus losses by minimizing runoff losses.

Pasture

Major management concerns: Erosion hazard, seasonal wetness, compaction
Management considerations:
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.
• Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Shrink-swell, seasonal wetness
Management considerations:
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Very slow permeability, seasonal wetness
Management considerations:
• Increasing the size of the absorption area helps to compensate for the restricted permeability.
• Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: None assigned
Michigan soil management group: 1a

77—Waucedah muck, frequently flooded

Setting

Landform: Flood plains
Slope: 0 to 1 percent
Shape of areas: Long and narrow
Size of areas: 60 to 200 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark gray muck

Subsurface layer:
9 to 13 inches—black, mottled silt loam

Substratum:
13 to 18 inches—dark gray, mottled silt loam
18 to 55 inches—dark grayish brown and black loamy sand and sandy loam
55 to 60 inches—brown silty clay

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: 2 feet above to 1 foot below the surface from October through May
Surface runoff: Ponded
Flooding: Frequent
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Waucedah and similar soils: About 95 percent
Contrasting inclusions: About 5 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Colonville soils in the slightly higher areas on flood plains

Similar inclusions:
• Soils that have a thinner surface layer of muck

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, plant competition
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.

• Landing sites generally can be used only during the driest time of the year.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

Buildings

Major management concerns: Seasonal flooding
Management considerations:
• Because of flooding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Seasonal flooding
Management considerations:
• Because of flooding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 3W
Michigan soil management group: L-2c

78—Pits, borrow

Setting

Slope: 0 to 35 percent
Shape of areas: Irregular
Size of areas: 5 to 150 acres

Typical Profile

0 to 80 inches—colors and textures variable

Composition

Pits: 100 percent

Use and Management

Land use: Source of gravel, sand, or fill material. Some areas have been excavated below the seasonal high water table and are ponded. A few pits contain small deposits of rubbish and trash.

Management considerations:
• Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned

80F—Zimmerman-Alcona complex, 25 to 60 percent slopes

Setting

Landform: Steep and very steep areas on dissected lake plains
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Typical Profile

Zimmerman

Surface layer:
0 to 2 inches—black loamy fine sand

Subsurface layer:
2 to 4 inches—grayish brown loamy fine sand

Subsoil:
4 to 7 inches—strong brown loamy fine sand
7 to 24 inches—yellowish brown loamy fine sand
24 to 80 inches—yellowish brown fine sand that has thin bands of strong brown loamy fine sand

Alcona

Surface layer:
0 to 1 inch—black loamy very fine sand

Subsurface layer:
1 to 3 inches—grayish brown loamy very fine sand

Subsoil:
3 to 8 inches—dark brown loamy very fine sand
8 to 12 inches—yellowish brown loamy very fine sand
12 to 16 inches—brown loamy very fine sand
16 to 21 inches—brown loam and light yellowish brown very fine sandy loam
21 to 41 inches—dark brown loam

Substratum:
41 to 60 inches—light yellowish brown loamy very fine sand

Soil Properties and Qualities

Permeability: Zimmerman—rapid; Alcona—moderate
Available water capacity: Zimmerman—low; Alcona—moderate
Drainage class: Zimmerman—excessively drained; Alcona—well drained

Depth to the water table: More than 6 feet
Surface runoff: Rapid
Flooding: None
Organic matter content: Zimmerman—low; Alcona—moderate
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Zimmerman and similar soils: 50 to 60 percent
Alcona and similar soils: 35 to 50 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
• The well drained Hoist soils, which have a substratum of sandy loam; in landscape positions similar to those of the major soils

Similar inclusions:
• Soils that are medium sand

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Zimmerman—equipment limitation, erosion hazard, slope, seedling mortality; Alcona—equipment limitation, erosion hazard, slope, plant competition
Management considerations:
• Ordinary crawler tractors and rubber-tired skidders cannot be operated safely because of the slope. As a result, special logging methods, such as yarding the logs with a cable, may be needed.
• Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Seedling survival rates can be increased on the Zimmerman soil by carefully planting vigorous nursery stock.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species on the Alcona soil.
• If trees are planted, site preparation is needed to control competing vegetation on the Alcona soil. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Slope
Management considerations:
• Because of the slope, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: Zimmerman—8R; Alcona—3R
Michigan soil management group: Zimmerman—4a; Alcona—3a-s

81B—Grayling sand, 0 to 6 percent slopes

Setting

Landform: Outwash plains and deltas
Shape of areas: Irregular
Size of areas: 50 to 1,000 acres

Typical Profile

Surface layer:
0 to 2 inches—black sand

Subsoil:
2 to 4 inches—dark yellowish brown sand
4 to 29 inches—yellowish brown sand

Substratum:
29 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Grayling and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Mancelona and East Lake soils
• The moderately well drained Croswell soils in the lower positions on the landscape

Similar inclusions:
• Soils that have bands of loamy sand in the substratum

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Poor filtering capacity
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.7a

81C—Grayling sand, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on outwash plains and deltas
Shape of areas: Irregular
Size of areas: 5 to 150 acres

Typical Profile

Surface layer:
0 to 2 inches—black sand

Subsoil:
2 to 4 inches—dark yellowish brown sand
4 to 29 inches—yellowish brown sand

Substratum:
29 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Grayling and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Glennie and McGinn soils in the higher positions on the landscape
• The somewhat excessively drained Mancelona soils
• The moderately well drained Croswell soils in the lower positions on the landscape

Similar inclusions:
• Soils that have bands of loamy sand in the substratum

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Poor filtering capacity
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
• Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.7a

81E—Grayling sand, 18 to 35 percent slopes

Setting

Landform: Escarpments and breaks to drainageways on deltas and outwash plains
Shape of areas: Elongated
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 2 inches—black sand

Subsoil:
2 to 4 inches—dark yellowish brown sand
4 to 29 inches—yellowish brown sand

Substratum:
29 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Grayling and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Mancelona soils

Similar inclusions:
• Soils that have bands of loamy sand in the substratum

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, erosion hazard, seedling mortality
Management considerations:
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes. Also, logging roads should be stabilized.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Planting special nursery stock or containerized

seedlings can reduce the seedling mortality rate.
• Planting when the soil is moist can also reduce the seedling mortality rate.

Buildings

Major management concerns: Slope, cutbanks cave
Management considerations:
• Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4R
Michigan soil management group: 5.7a

82C—Udorthents, loamy, nearly level to gently rolling

Setting

Landform: Ridges and knolls on lake plains and moraines
Slope: 0 to 12 percent
Shape of areas: Irregular
Size of areas: 5 to 25 acres

Typical Profile

Surface layer:
0 to 3 inches—reddish brown loam

Substratum:
3 to 60 inches—reddish brown loam

Soil Properties and Qualities

Permeability: Moderate or moderately slow
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Slow to rapid
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight to severe
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Udorthents and similar soils: 100 percent

Inclusions

Similar inclusions:
• Soils that have more clay in the substratum
• Soils that are sandy loam

Use and Management

Land use: Former use—source of borrow material; current use—none

Management considerations:
• Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned

83F—Udipsamments, nearly level to very steep

Setting

Landform: Ridges and knolls on lake plains, outwash plains, and moraines
Slope: 0 to 40 percent
Shape of areas: Irregular
Size of areas: 5 to 25 acres

Typical Profile

Surface layer:
0 to 6 inches—yellowish brown sand

Substratum:
6 to 60 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Very low
Drainage class: Excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Very slow to medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Udipsamments and similar soils: About 95 percent
Contrasting inclusions: About 5 percent

Inclusions

Contrasting inclusions:
• The very poorly drained Aquents in depressions

Similar inclusions:
• Soils that have loamy bands in the substratum

Use and Management

Land use: Former use—source of borrow material; current use—idle land

Management considerations:
• Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned

84B—Zimmerman loamy fine sand, 0 to 6 percent slopes

Setting

Landform: Lake terraces and deltas
Shape of areas: Irregular
Size of areas: 10 to 400 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy fine sand

Subsurface layer:
2 to 4 inches—grayish brown loamy fine sand

Subsoil:
4 to 7 inches—strong brown loamy fine sand
7 to 24 inches—yellowish brown loamy fine sand
24 to 80 inches—yellowish brown fine sand that has thin bands of strong brown loamy fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Zimmerman and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The moderately well drained Alcona soils, which contain more clay than the Zimmerman soil; in landscape positions similar to those of the Zimmerman soil

Similar inclusions:
• Soils that are medium sand

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building sites

Pasture

Major management concerns: Seasonal droughtiness, erosion hazard
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Seedling mortality
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Poor filtering capacity
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Large lots, an absorption system of shallow

trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 8S
Michigan soil management group: 4a

84C—Zimmerman loamy fine sand, 6 to 12 percent slopes

Setting

Landform: Ridges and knolls on lake terraces and deltas
Shape of areas: Irregular
Size of areas: 5 to 300 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy fine sand

Subsurface layer:
2 to 4 inches—grayish brown loamy fine sand

Subsoil:
4 to 7 inches—strong brown loamy fine sand
7 to 24 inches—yellowish brown loamy fine sand
24 to 80 inches—yellowish brown fine sand that has thin bands of strong brown loamy fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Zimmerman and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The moderately well drained Alcona soils, which contain more clay than the Zimmerman soil; in landscape positions similar to those of the Zimmerman soil

Similar inclusions:
• Soils that are medium sand

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building sites

Pasture

Major management concerns: Seasonal droughtiness, erosion hazard
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Seedling mortality
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Poor filtering capacity
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 8S
Michigan soil management group: 4a

84D—Zimmerman loamy fine sand, 12 to 18 percent slopes

Setting

Landform: Ridges and knolls on lake terraces and deltas
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy fine sand

Subsurface layer:
2 to 4 inches—grayish brown loamy fine sand

Subsoil:
4 to 7 inches—strong brown loamy fine sand
7 to 24 inches—yellowish brown loamy fine sand
24 to 80 inches—yellowish brown fine sand that has thin bands of strong brown loamy fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Zimmerman and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Alcona soils, which contain more clay than the Zimmerman soil; in landscape positions similar to those of the Zimmerman soil

Similar inclusions:
• Soils that have coarser sand

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Seedling mortality
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Seedling survival rates can be increased by carefully planting vigorous nursery stock.

Buildings

Major management concerns: Slope, cutbanks cave
Management considerations:
• Land shaping may be necessary to develop a suitable building site.
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Slope, poor filtering capacity
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 8S
Michigan soil management group: 4a

85B—Zimmerman-Alcona, moderately wet, complex, 0 to 6 percent slopes

Setting

Landform: Lake terraces and deltas
Shape of areas: Irregular
Size of areas: 20 to 1,000 acres

Typical Profile

Zimmerman

Surface layer:
0 to 2 inches—black loamy fine sand

Subsurface layer:
2 to 4 inches—grayish brown loamy fine sand

Subsoil:
4 to 7 inches—strong brown loamy fine sand

7 to 24 inches—yellowish brown loamy fine sand
24 to 80 inches—yellowish brown fine sand that has thin bands of strong brown loamy fine sand

Alcona

Surface layer:
0 to 1 inch—black loamy very fine sand

Subsurface layer:
1 to 3 inches—grayish brown loamy very fine sand

Subsoil:
3 to 8 inches—dark brown loamy very fine sand
8 to 12 inches—yellowish brown loamy very fine sand
12 to 16 inches—brown loamy very fine sand
16 to 21 inches—brown, mottled loam and light yellowish brown, mottled very fine sandy loam
21 to 41 inches—dark brown, mottled loam

Substratum:
41 to 60 inches—light yellowish brown, mottled loamy very fine sand

Soil Properties and Qualities

Permeability: Zimmerman—rapid; Alcona—moderate
Available water capacity: Zimmerman—low; Alcona—moderate
Drainage class: Zimmerman—excessively drained; Alcona—moderately well drained
Seasonal high water table: Zimmerman—at a depth of more than 6 feet; Alcona—perched at a depth of 2.5 to 6.0 feet from November through May
Surface runoff: Zimmerman—very slow; Alcona—slow
Flooding: None
Organic matter content: Zimmerman—low; Alcona—moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Zimmerman and similar soils: 50 to 60 percent
Alcona and similar soils: 40 to 50 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
• The moderately well drained Hoist soils

Similar inclusions:
• Soils that have coarser sand

Use and Management

Land use: Dominant use—woodland; other uses—pasture, cropland, building sites

Cropland

Major management concerns: Zimmerman—soil blowing, seasonal droughtiness, low organic matter content, nutrient loss; Alcona—soil blowing
Management considerations:
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.
• Leaving crop residue on the surface and adding other organic material conserve moisture.
• Conservation tillage and additions of organic material increase the organic matter content and the available water capacity.
• Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and can help to prevent ground-water pollution.
• Seasonal wetness may delay site preparation and planting in the spring in areas of the Alcona soil.

Pasture

Major management concerns: Zimmerman—seasonal droughtiness, erosion hazard; Alcona—overgrazing
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Zimmerman—equipment limitation, seedling mortality; Alcona—equipment limitation, plant competition
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate on the Zimmerman soil.
• Because of low strength, suitable surfacing

material is needed on year-round logging roads and landings in areas of the Alcona soil.
• Skidders should not be used in areas of the Alcona soil during wet periods, when ruts form easily.
• If trees are planted, site preparation is needed to control competing vegetation on the Alcona soil. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave
Management considerations:
• Caving of cutbanks is a concern affecting shallow excavations. Trench walls should be reinforced on both soils.
• Wetness in areas of the Alcona soil can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Zimmerman—poor filtering capacity; Alcona—seasonal wetness
Management considerations:
• The poor filtering capacity of the Zimmerman soil can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
• Filling or mounding with suitable material helps to raise the absorption field above the water table in areas of the Alcona soil.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: Zimmerman—8S; Alcona—3L
Michigan soil management group: Zimmerman—4a; Alcona—3a-s

85D—Zimmerman-Alcona, moderately wet, complex, 6 to 18 percent slopes

Setting

Landform: Ridges on dissected lake plains
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Typical Profile

Zimmerman

Surface layer:
0 to 2 inches—black loamy fine sand

Subsurface layer:
2 to 4 inches—grayish brown loamy fine sand

Subsoil:
4 to 7 inches—strong brown loamy fine sand
7 to 24 inches—yellowish brown loamy fine sand
24 to 80 inches—yellowish brown fine sand that has thin bands of strong brown loamy fine sand

Alcona

Surface layer:
0 to 1 inch—black loamy very fine sand

Subsurface layer:
1 to 3 inches—grayish brown loamy very fine sand

Subsoil:
3 to 8 inches—dark brown loamy very fine sand
8 to 12 inches—yellowish brown loamy very fine sand
12 to 16 inches—brown loamy very fine sand
16 to 21 inches—brown, mottled loam and light yellowish brown, mottled very fine sandy loam
21 to 41 inches—dark brown, mottled loam

Substratum:
41 to 60 inches—light yellowish brown, mottled loamy very fine sand

Soil Properties and Qualities

Permeability: Zimmerman—rapid; Alcona—moderate
Available water capacity: Zimmerman—low; Alcona—moderate
Drainage class: Zimmerman—excessively drained; Alcona—moderately well drained
Seasonal high water table: Zimmerman—at a depth of more than 6 feet; Alcona—perched at a depth of 2.5 to 6.0 feet from November through May
Surface runoff: Zimmerman—slow or medium; Alcona—medium
Flooding: None
Organic matter content: Zimmerman—low; Alcona—moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Zimmerman and similar soils: 50 to 60 percent
Alcona and similar soils: 35 to 50 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The well drained Hoist soils in landscape positions similar to those of the major soils

Similar inclusions:
- Soils that are medium sand

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: Zimmerman—equipment limitation, seedling mortality; Alcona—equipment limitation, plant competition, erosion hazard

Management considerations:
- Because loose sand in areas of the Zimmerman soil can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings in areas of the Alcona soil.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate on the Zimmerman soil.
- Planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate. Replanting is needed in some areas of the Zimmerman soil.
- If trees are planted, site preparation is needed to control competing vegetation on the Alcona soil. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Zimmerman—cutbanks cave, slope; Alcona—cutbanks cave, slope, seasonal wetness

Management considerations:
- Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
- Land shaping may be necessary to develop a suitable building site.
- Seasonal wetness in areas of the Alcona soil can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Zimmerman—poor filtering capacity, slope; Alcona—seasonal wetness

Management considerations:
- The poor filtering capacity of the Zimmerman soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table in areas of the Alcona soil.
- Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly.

Interpretive Groups

Land capability classification: VIs

Woodland ordination symbol: Zimmerman—8S; Alcona—3L

Michigan soil management group: Zimmerman—4a; Alcona—3a-s

86—Histosols and Aquents, ponded

Setting

Landform: Depressions on lake terraces, outwash plains, and flood plains

Slope: 0 to 1 percent

Shape of areas: Oval, elongated, or irregular

Size of areas: 5 to 100 acres

Soil Properties and Qualities

Texture: Histosols—muck; Aquents—sandy or loamy material

Permeability: Rapid to slow

Available water capacity: Low to high

Drainage class: Very poorly drained

Seasonal high water table: At the surface to 1 foot above the surface year-round

Surface runoff: Ponded

Flooding: None to frequent

Organic matter content: High

Hazard of water erosion: Slight

Hazard of soil blowing: Slight

Composition

Aquents: 0 to 100 percent

Histosols: 0 to 100 percent

Contrasting inclusions: 0 to 5 percent

Contrasting Inclusions

- Small areas of poorly drained or somewhat poorly drained soils on islands

Use and Management

Land use: Wetland wildlife habitat

Management considerations:
• Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned

87—Ausable muck, frequently flooded

Setting

Landform: Flood plains
Slope: 0 to 1 percent
Shape of areas: Long and narrow
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 8 inches—black muck

Substratum:
8 to 17 inches—dark grayish brown, mottled loamy sand that has thin bands of black muck
17 to 35 inches—olive, mottled loamy sand
35 to 60 inches—olive gray sand

Soil Properties and Qualities

Permeability: Moderate and moderately rapid in the upper part of the surface layer and in the subsoil; rapid in the substratum
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Ponded
Flooding: Frequent
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Ausable and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
• Aquents, which are ponded year-round

Similar inclusions:
• Soils that have thicker layers of muck in the surface layer and subsoil

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, windthrow hazard, seedling mortality, plant competition
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
• Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
• Landing sites generally can be used only during the driest time of the year.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

Buildings

Major management concerns: Seasonal flooding
Management considerations:
• Because of flooding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Seasonal flooding
Management considerations:
• Because of flooding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIw
Woodland ordination symbol: 2W
Michigan soil management group: L-4c

88D—Hoist sandy loam, 12 to 18 percent slopes

Setting

Landform: Ridges and knolls on till plains and drumlins

Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown sandy loam

Subsoil:
9 to 14 inches—yellowish brown sandy loam
14 to 21 inches—brown and reddish brown sandy loam
21 to 27 inches—reddish brown loam
27 to 49 inches—light reddish brown sandy loam

Substratum:
49 to 80 inches—light reddish brown sandy loam

Soil Properties and Qualities

Permeability: Moderately rapid in the upper part of the subsoil; moderately slow in the lower part of the subsoil; very slow in the substratum
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Rapid
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Hoist and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in the lower positions on the landscape
• The well drained Negwegon soils, which contain more clay than the Hoist soil
• The somewhat excessively drained Graycalm soils on breaks to drainageways

Similar inclusions:
• Soils that have a surface layer of loam

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Erosion hazard, soil blowing, tilth in the surface layer
Management considerations:
• Water erosion can be controlled by diversions, crop residue management, contour stripcropping, field stripcropping, cover crops, grassed waterways, conservation tillage, crop rotations that include grasses and legumes, grade-stabilization structures, or a combination of these.
• Conservation tillage, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.
• Crop residue management, green manure crops, applications of manure, cover crops, and conservation tillage can maintain or improve tilth and increase the available water capacity and the organic matter content.

Pasture

Major management concerns: Erosion hazard
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, plant competition
Management considerations:
• Skidders should not be used during wet periods, when ruts form easily. Year-round logging roads require a gravel base.
• Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Cutbanks cave, slope
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Land shaping may be necessary to develop a suitable building site.

Septic tank absorption fields

Major management concerns: Moderately slow permeability, slope
Management considerations:
• Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 3L
Michigan soil management group: 3a

89F—Bamfield-Lupton complex, 0 to 45 percent slopes

Setting

Landform: Bamfield—steep and very steep areas; Lupton—depressions on dissected moraines
Distinctive landscape features: Pitted landscape
Shape of areas: Irregular
Size of areas: 25 to 300 acres

Typical Profile

Bamfield

Organic mat:
0 to 1 inch—partially decomposed leaf litter

Surface layer:
1 to 6 inches—very dark grayish brown fine sandy loam

Subsoil:
6 to 11 inches—yellowish brown fine sandy loam
11 to 18 inches—pinkish gray fine sandy loam
18 to 31 inches—reddish brown clay loam and pinkish gray fine sandy loam
31 to 60 inches—light reddish brown clay loam

Lupton

Surface layer:
0 to 5 inches—black muck

Substratum:
5 to 60 inches—dark reddish brown muck

Soil Properties and Qualities

Permeability: Bamfield—very slow; Lupton—moderately slow to moderately rapid
Available water capacity: Bamfield—moderate; Lupton—very high
Drainage class: Bamfield—well drained; Lupton—very poorly drained
Seasonal high water table: Bamfield—at a depth of more than 6 feet; Lupton—at the surface to 2 feet above the surface year-round
Surface runoff: Bamfield—rapid and very rapid; Lupton—ponded
Flooding: None
Organic matter content: Bamfield—moderate; Lupton—high
Hazard of water erosion: Bamfield—severe; Lupton—slight
Hazard of soil blowing: Bamfield—moderate; Lupton—slight
Shrink-swell potential: Bamfield—low in the upper part and moderate in the lower part; Lupton—none

Composition

Bamfield and similar soils: 55 to 70 percent
Lupton and similar soils: 25 to 45 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The well drained Nester soils, which have more clay in the upper part of the subsoil; in landscape positions similar to those of the major soils
• The somewhat excessively drained Graycalm soils in landscape positions similar to those of the major soils

Similar inclusions:
• Soils that are moderately well drained

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: Equipment limitation, erosion hazard, plant competition
Management considerations:
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment in areas of the Bamfield soil. Logging roads should be designed so that they conform to the topography.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.

• Because of the erosion hazard on the Bamfield soil, logging roads and skid roads should be established on the contour and water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• Because of ponding, the Lupton soil does not support trees.

Buildings

Major management concerns: Bamfield—shrink-swell, slope; Lupton—ponding
Management considerations:
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling on the Bamfield soil.
• Land shaping may be necessary to develop a suitable building site.
• In areas where slopes are more than 25 percent, the Bamfield soil is generally unsuited to building site development.
• Because of ponding, the Lupton soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Bamfield—restricted permeability, slope; Lupton—ponding
Management considerations:
• Increasing the size of the absorption area helps to compensate for the restricted permeability of the Bamfield soil.
• Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly in areas of the Bamfield soil.
• In areas where slopes are more than 15 percent, the Bamfield soil is generally unsuited to septic tank absorption fields.
• Because of ponding, the Lupton soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: Bamfield—3R; Lupton—none assigned
Michigan soil management group: Bamfield—1.5a; Lupton—Mc

90B—Chinwhisker sand, 0 to 4 percent slopes

Setting

Landform: Stream terraces, outwash plains, and lake terraces
Shape of areas: Irregular
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 3 inches—dark grayish brown sand

Subsoil:
3 to 8 inches—dark brown sand
8 to 21 inches—yellowish brown sand
21 to 25 inches—light yellowish brown sand
25 to 36 inches—light yellowish brown, mottled sand
36 to 80 inches—pale brown, mottled sand that has thin bands of dark brown loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Moderately well drained
Depth to the water table: 2.5 to 4.0 feet from October through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Chinwhisker and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Richter soils in depressions
• The poorly drained Leafriver soils in depressions

Similar inclusions:
• Soils that have a calcareous substratum

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building sites

Pasture

Major management concerns: Seasonal droughtiness, soil blowing
Management considerations:
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Cutbanks cave, seasonal wetness
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Seasonal wetness, poor filtering capacity
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Mounding or adding suitable fill material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 6S
Michigan soil management group: 5a

91E—Glennie-Lupton complex, 0 to 35 percent slopes

Setting

Landform: Glennie—steep and very steep areas; Lupton—depressions on disintegration moraines
Shape of areas: Irregular
Size of areas: 50 to 300 acres

Typical Profile

Glennie

Organic mat:
0 to 2 inches—black, partially decomposed forest litter
Surface layer:
2 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown loamy sand

Subsoil:
7 to 11 inches—dark brown sandy loam
11 to 20 inches—strong brown loamy sand
20 to 40 inches—brown loamy sand and reddish brown loam
40 to 46 inches—reddish brown sandy clay loam and brown sandy loam
46 to 56 inches—dark reddish brown clay
56 to 85 inches—reddish brown sandy clay loam

Substratum:
85 to 99 inches—reddish brown sandy clay loam

Lupton

Surface layer:
0 to 5 inches—black muck

Subsurface layer:
5 to 60 inches—dark reddish brown muck

Soil Properties and Qualities

Permeability: Glennie—rapid in the sandy part, very slow in the loamy and clayey parts; Lupton—moderately slow to moderately rapid
Available water capacity: Glennie—moderate; Lupton—very high
Drainage class: Glennie—well drained; Lupton—very poorly drained
Seasonal high water table: Glennie—at a depth of more than 6 feet; Lupton—at the surface to 2 feet above the surface year-round
Surface runoff: Glennie—rapid; Lupton—ponded

Flooding: None
Organic matter content: Glennie—moderate; Lupton—high
Hazard of water erosion: Glennie—severe; Lupton—slight
Hazard of soil blowing: Glennie—moderate; Lupton—slight
Shrink-swell potential: Glennie—low in the upper part and moderate in the lower part; Lupton—none

Composition

Glennie and similar soils: 60 to 70 percent
Lupton and similar soils: 20 to 40 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Graycalm soils, which have a sandy profile; in landscape positions similar to those of the major soils
• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in landscape positions similar to those of the major soils
• The very poorly drained Loxley soils in closed depressions

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: Equipment limitation, erosion hazard, windthrow hazard, plant competition
Management considerations:
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment in areas of the Glennie soil. Logging roads should be designed so that they conform to the topography.
• Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
• Because of the erosion hazard on the Glennie soil, logging roads and skid roads should be established on the contour and water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.
• Because of ponding, the Lupton soil does not support trees.

Buildings

Major management concerns: Glennie—shrink-swell, cutbanks cave, slope; Lupton—ponding
Management considerations:
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling of the Glennie soil.
• Land shaping may be necessary to develop a suitable building site.
• In areas where slopes are more than 25 percent, the Glennie soil is generally unsuited to building site development.
• Because of ponding, the Lupton soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Glennie—very slow permeability, slope; Lupton—ponding
Management considerations:
• Increasing the size of the absorption area helps to compensate for the restricted permeability of the Glennie soil.
• Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly in areas of the Glennie soil.
• In areas where slopes are more than 15 percent, the Glennie soil is generally unsuited to septic tank absorption fields.
• Because of ponding, the Lupton soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: Glennie—5R; Lupton—none assigned
Michigan soil management group: Glennie—4/2a-f; Lupton—Mc

92B—Klacking-McGinn loamy sands, 0 to 6 percent slopes

Setting

Landform: Ground moraines
Shape of areas: Irregular

Size of areas: 40 to 150 acres

Typical Profile

Klacking

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 3 inches—brown loamy sand

Subsoil:
3 to 19 inches—dark yellowish brown loamy sand
19 to 27 inches—yellowish brown loamy sand
27 to 40 inches—light yellowish brown loamy sand that has bands of dark brown sandy loam
40 to 46 inches—dark brown sandy loam and light yellowish brown loamy sand
46 to 60 inches—light yellowish brown loamy sand that has bands of dark brown sandy loam

McGinn

Organic mat:
0 to 1 inch—black, partially decomposed leaf litter

Surface layer:
1 to 2 inches—black loamy sand

Subsurface layer:
2 to 4 inches—light brownish gray loamy sand

Subsoil:
4 to 6 inches—strong brown loamy sand
6 to 16 inches—dark yellowish brown loamy sand
16 to 25 inches—grayish brown loamy sand and reddish brown sandy loam
25 to 35 inches—reddish brown sandy loam

Substratum:
35 to 80 inches—light reddish brown sandy loam

Soil Properties and Qualities

Permeability: Klacking—moderately rapid; McGinn—moderately rapid in the sandy part, moderate in the loamy part
Available water capacity: Klacking—low; McGinn—moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Klacking and similar soils: 60 to 70 percent
McGinn and similar soils: 25 to 35 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in landscape positions similar to those of the major soils
• The very poorly drained Lupton soils in depressions

Similar inclusions:
• Soils that are moderately well drained
• Soils that have a surface layer of sandy loam

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: Seedling mortality
Management considerations:
• Seedling survival rates can be increased by carefully planting vigorous nursery stock.
• If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Cutbanks cave
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: None

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: Klacking—6S; McGinn—4S
Michigan soil management group: Klacking—4a; McGinn—4a

93B—Au Gres, clayey substratum-Wakeley complex, 0 to 4 percent slopes

Setting

Landform: Au Gres—ridges; Wakeley—swales on lake terraces

Shape of areas: Elongated
Size of areas: 40 to 500 acres

Typical Profile

Au Gres

Organic mat:
0 to 1 inch—black, partially decomposed forest leaf litter

Surface layer:
1 to 15 inches—dark gray and light gray sand

Subsoil:
15 to 23 inches—very dusky red and strong brown, mottled sand
23 to 32 inches—pale brown, stratified, mottled sand and loamy sand
32 to 44 inches—strong brown and grayish brown, mottled loamy sand

Substratum:
44 to 58 inches—pinkish gray sand
58 to 80 inches—reddish brown, mottled silty clay

Wakeley

Surface layer:
0 to 6 inches—black, mottled mucky sand

Subsoil:
6 to 12 inches—gray sand

Substratum:
12 to 24 inches—grayish brown, mottled sand
24 to 29 inches—grayish brown, mottled, stratified sand and loamy sand
29 to 34 inches—pinkish gray, mottled clay
34 to 60 inches—pinkish gray, mottled, stratified clay and silty clay

Soil Properties and Qualities

Permeability: Rapid in the sandy part; very slow in the clayey part
Available water capacity: Low
Drainage class: Au Gres—somewhat poorly drained; Wakeley—very poorly drained
Seasonal high water table: Au Gres—perched at a depth of 1 to 3 feet from October through May; Wakeley—1 foot above to 1 foot below the surface from October through May
Surface runoff: Au Gres—very slow; Wakeley—ponded
Flooding: None
Organic matter content: Au Gres—low; Wakeley—high
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low in the upper part and high in the lower part

Composition

Au Gres and similar soils: 50 to 60 percent
Wakeley and similar soils: 35 to 50 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The very poorly drained Leafriver soils, which have clay below a depth of 60 inches; in landscape positions similar to those of the Wakeley soil

Similar inclusions:
• Soils that have thinner sandy layers

Use and Management

Land use: Dominant use—woodland; other use—pasture

Pasture

Major management concerns: Seasonal wetness
Management considerations:
• Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.
• Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants.

Woodland

Major management concerns: Au Gres—equipment limitation, windthrow hazard, plant competition; Wakeley—equipment limitation, windthrow hazard, plant competition, seedling mortality
Management considerations:
• Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
• Equipment can be used only during dry summer months and during periods in winter when the snow cover is adequate or the soil is frozen.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Carefully managed reforestation helps to control undesirable understory plants.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.

• Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Wakeley soil.

Buildings

Major management concerns: Au Gres—cutbanks cave, seasonal wetness; Wakeley—ponding
Management considerations:
• Because cutbanks in areas of the Au Gres soil are not stable and are subject to caving, trench walls should be reinforced.
• Because of ponding, the Wakeley soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Au Gres—poor filtering capacity, very slow permeability, seasonal wetness; Wakeley—ponding
Management considerations:
• The poor filtering capacity of the Au Gres soil can result in the pollution of ground water.
• Increasing the size of the absorption area helps to compensate for the restricted permeability of the Au Gres soil.
• In areas of the Au Gres soil, mounding or adding suitable fill material helps to raise the absorption field above the water table and increases the thickness of the filtering material.
• Because of ponding, the Wakeley soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: IVw
Woodland ordination symbol: Au Gres—7W; Wakeley—3W
Michigan soil management group: Au Gres—5b; Wakeley—4/1c

94F—Klacking-McGinn loamy sands, 8 to 50 percent slopes, dissected

Setting

Landform: Klacking—sides of valleys; McGinn—ridgetops on dissected moraines
Distinctive landscape features: Dissected landscape
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Typical Profile

Klacking

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 3 inches—brown loamy sand

Subsoil:
3 to 19 inches—dark yellowish brown loamy sand
19 to 27 inches—yellowish brown loamy sand
27 to 40 inches—light yellowish brown loamy sand that has bands of dark brown sandy loam
40 to 46 inches—dark brown sandy loam and light yellowish brown loamy sand
46 to 60 inches—light yellowish brown loamy sand that has bands of dark brown sandy loam

McGinn

Organic mat:
0 to 1 inch—black, partially decomposed leaf litter

Surface layer:
1 to 2 inches—black loamy sand

Subsurface layer:
2 to 4 inches—light brownish gray loamy sand

Subsoil:
4 to 6 inches—strong brown loamy sand
6 to 16 inches—dark yellowish brown loamy sand
16 to 25 inches—grayish brown loamy sand and reddish brown sandy loam
25 to 35 inches—reddish brown sandy loam

Substratum:
35 to 80 inches—light reddish brown sandy loam

Soil Properties and Qualities

Permeability: Klacking—moderately rapid; McGinn—moderately rapid in the sandy part, moderate in the loamy part
Available water capacity: Klacking—low; McGinn—moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Klacking and similar soils: 60 to 70 percent
McGinn and similar soils: 25 to 35 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Mancelona

soils, which have very gravelly sand in the substratum; in landscape positions similar to those of the major soils
• The poorly drained Lupton soils in valley bottoms

Similar inclusions:
• Soils that are moderately well drained

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, erosion hazard, seedling mortality
Management considerations:
• Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of ravines.
• Skid roads and trails should be located in the less sloping areas between the ravines.
• Control of concentrated water on logging roads and skid roads reduces the hazard of erosion.
• Seedling survival rates can be increased by carefully planting vigorous nursery stock.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species in areas of the McGinn soil.
• Carefully managed reforestation helps to control undesirable understory plants in areas of the McGinn soil.

Buildings

Major management concerns: Slope, cutbanks cave
Management considerations:
• Land shaping may be necessary to develop a suitable building site.
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• In areas that have slopes of more than 25 percent, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.
• In areas that have slopes of more than 15 percent, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: Klacking—6R; McGinn—4R
Michigan soil management group: Klacking—4a; McGinn—4a

96D2—Negwegon silty clay loam, 12 to 18 percent slopes, eroded

Setting

Landform: Ridges and knolls on lake plains
Distinctive landscape features: Eroded surface
Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 6 inches—dark brown silty clay loam and reddish brown silty clay

Subsoil:
6 to 10 inches—reddish brown silty clay loam and silty clay
10 to 40 inches—reddish brown silty clay

Substratum:
40 to 60 inches—stratified brown silty clay loam and yellowish brown silt loam

Soil Properties and Qualities

Permeability: Very slow
Available water capacity: High
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Rapid
Flooding: None
Organic matter content: Low
Hazard of water erosion: Severe
Hazard of soil blowing: Slight
Shrink-swell potential: High

Composition

Negwegon and similar soils: About 95 percent
Contrasting inclusions: About 5 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Algonquin soils in drainageways

Similar inclusions:
• Soils that have a darker surface layer

Use and Management

Land use: Dominant use—cropland; other use—pasture

Cropland

Major management concerns: Erosion hazard, low organic matter content, tilth in the surface layer, soil compaction, nutrient loss
Management considerations:
• Water erosion can be controlled by diversions, crop residue management, contour stripcropping, field stripcropping, cover crops, grassed waterways, conservation tillage, crop rotations that include grasses and legumes, grade-stabilization structures, or a combination of these.
• Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, permeability, and the rate of water infiltration.
• Minimizing tillage and tilling at the proper soil moisture content help to maintain good tilth.
• Crop rotations and the use of legumes may reduce the need for commercial fertilizer. Sod-based rotations significantly reduce dissolved and particulate nitrogen and phosphorus losses by minimizing runoff losses.

Pasture

Major management concerns: Erosion hazard, compaction
Management considerations:
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.
• Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Shrink-swell, slope
Management considerations:
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Land shaping may be necessary to develop a suitable building site.

Septic tank absorption fields

Major management concerns: Very slow permeability, slope
Management considerations:
• Backfilling the trenches with porous material and increasing the size of the absorption area help to overcome the restricted permeability.
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: None assigned
Michigan soil management group: 1a

97—Colonville very fine sandy loam, occasionally flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Shape of areas: Long and narrow
Size of areas: 60 to 200 acres

Typical Profile

Surface layer:
0 to 11 inches—very dark gray very fine sandy loam

Substratum:
11 to 22 inches—yellowish brown and very dark grayish brown, mottled, stratified loamy fine sand and fine sandy loam
22 to 38 inches—dark gray and brown, mottled, stratified fine sandy loam and loamy fine sand
38 to 52 inches—very dark grayish brown, mottled very fine sand
52 to 60 inches—gray, mottled silt loam

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: High
Drainage class: Somewhat poorly drained
Depth to the water table: 1 to 2 feet from October through May
Surface runoff: Very slow
Flooding: Occasional
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Composition

Colonville and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The very poorly drained Waucedah soils in the lower positions on the flood plain

Similar inclusions:
• Soils that have a surface layer of mucky very fine sandy loam

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, windthrow hazard, plant competition
Management considerations:
• Equipment should be used only when the soil is relatively dry or has an adequate snow cover.
• Skidders should not be used during wet periods, when ruts form easily.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced and by using such harvest methods as selective cutting and strip cutting.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Carefully managed reforestation helps to control undesirable understory plants.

Buildings

Major management concerns: Seasonal flooding
Management considerations:
• Because of flooding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Seasonal flooding
Management considerations:
• Because of flooding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 3W
Michigan soil management group: L-2c

98C—Graycalm sand, pitted outwash, 0 to 12 percent slopes

Setting

Landform: Outwash plains
Distinctive landscape features: Pitted landscape
Shape of areas: Irregular
Size of areas: 100 to 200 acres

Typical Profile

Surface layer:
0 to 1 inch—black sand

Subsoil:
1 to 4 inches—strong brown sand
4 to 46 inches—strong brown loamy sand
46 to 80 inches—light yellowish brown sand that has bands of brown loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Depth to the water table: More than 6 feet
Surface runoff: Very slow or slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low

Composition

Graycalm and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
• The moderately well drained Chinwhisker soils in depressions
• The somewhat excessively drained Mancelona soils, which have very gravelly sand in the substratum; in landscape positions similar to those of the Graycalm soil
• The very poorly drained Lupton soils in closed depressions

Similar inclusions:
• Soils that do not have bands in the substratum

Use and Management

Land use: Dominant use—woodland; other use—building sites

Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

Buildings

Major management concerns: Cutbanks cave, slope

Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Some land grading may be needed.

Septic tank absorption fields

Major management concerns: Poor filtering capacity
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 6S
Michigan soil management group: 5a

102D—Nester loam, 12 to 18 percent slopes

Setting

Landform: Ridges and knolls on till plains and moraines
Shape of areas: Irregular
Size of areas: 20 to 75 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loam

Subsoil:
9 to 14 inches—brown sandy loam and reddish brown clay loam
14 to 40 inches—reddish brown clay loam

Substratum:
40 to 60 inches—light reddish brown clay loam

Soil Properties and Qualities

Permeability: Slow
Available water capacity: High
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Rapid
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Severe
Hazard of soil blowing: Slight
Shrink-swell potential: Moderate

Composition

Nester and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Bamfield and Glennie soils, which contain less clay in the subsoil than the Nester soil; in landscape positions similar to those of the Nester soil

Similar inclusions:
• Soils that are moderately well drained

Use and Management

Land use: Dominant use—woodland; other uses—cropland, pasture, building sites

Cropland

Major management concerns: Erosion hazard, tilth in the surface layer, nutrient loss
Management considerations:
• Water erosion can be controlled by diversions, crop residue management, contour stripcropping, field stripcropping, cover crops, grassed waterways, conservation tillage, crop rotations that include grasses and legumes, grade-stabilization structures, or a combination of these.
• Minimizing tillage and tilling at the proper soil moisture content help to maintain good tilth.
• Crop rotations and the use of legumes may reduce the need for commercial fertilizer. Sod-based rotations significantly reduce dissolved and particulate nitrogen and phosphorus losses by minimizing runoff losses.

Pasture

Major management concerns: Erosion hazard, compaction
Management considerations:
• Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.
• Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, plant competition
Management considerations:
• Because of low strength, suitable surfacing

material is needed on year-round logging roads and landings.
• Skidders should not be used during wet periods, when ruts form easily.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Slope, shrink-swell
Management considerations:
• Land shaping may be necessary to develop a suitable building site.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 3L
Michigan soil management group: 1.5a

102E—Nester loam, 18 to 25 percent slopes

Setting

Landform: Steep areas on moraines
Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loam

Subsoil:
9 to 14 inches—brown sandy loam and reddish brown clay loam
14 to 40 inches—reddish brown clay loam

Substratum:
40 to 60 inches—light reddish brown clay loam

Soil Properties and Qualities

Permeability: Slow
Available water capacity: High
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Rapid
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Severe
Hazard of soil blowing: Slight
Shrink-swell potential: Moderate

Composition

Nester and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Alcona soils, which contain less clay in the subsoil than the Nester soil; in landscape positions similar to those of the Nester soil

Similar inclusions:
• Soils that are moderately well drained

Use and Management

Land use: Dominant use—woodland; other use—pasture

Pasture

Major management concerns: Erosion hazard, compaction
Management considerations:
• Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.
• Proper stocking rates and short-duration grazing during the summer help to control water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Erosion hazard, equipment limitation, plant competition
Management considerations:
• Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
• Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.

• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is poorly suited to building site development unless extensive land shaping is applied.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: 3R
Michigan soil management group: 1.5a

102F—Nester loam, 25 to 45 percent slopes

Setting

Landform: Very steep areas on moraines
Shape of areas: Irregular
Size of areas: 5 to 40 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loam

Subsoil:
9 to 14 inches—brown sandy loam and reddish brown clay loam
14 to 40 inches—reddish brown clay loam

Substratum:
40 to 60 inches—light reddish brown clay loam

Soil Properties and Qualities

Permeability: Slow
Available water capacity: High
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Very rapid
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Severe
Hazard of soil blowing: Slight
Shrink-swell potential: Moderate

Composition

Nester and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Alcona soils, which contain less clay in the subsoil than the Nester soil; in landscape positions similar to those of the Nester soil

Similar inclusions:
• Soils that are moderately well drained

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, erosion hazard, plant competition
Management considerations:
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
• Because of the slope, ordinary crawler tractors and rubber-tired skidders cannot be operated safely in some areas. As a result, special logging methods, such as yarding the logs with a cable, may be needed.
• Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• The grade should be kept as low as possible.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Special harvest methods may be needed to control undesirable plants.

Buildings

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope

Management considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 3R
Michigan soil management group: 1.5a

110D—Negwegon silt loam, 12 to 18 percent slopes

Setting

Landform: Ridges on dissected lake plains
Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 8 inches—dark brown silt loam

Subsoil:
8 to 16 inches—reddish brown silty clay loam and brown silt loam
16 to 46 inches—reddish brown silty clay

Substratum:
46 to 60 inches—stratified brown silty clay loam and yellowish brown silt loam

Soil Properties and Qualities

Permeability: Very slow
Available water capacity: High
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Rapid
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Severe
Hazard of soil blowing: Slight
Shrink-swell potential: High

Composition

Negwegon and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Alcona soils, which contain less clay than the Negwegon soil; in landscape positions similar to those of the Negwegon soil

Similar inclusions:
• Soils that are moderately well drained

Use and Management

Land use: Dominant use—woodland; other uses—pasture, cropland, building sites

Cropland

Major management concerns: Erosion hazard, tilth in the surface layer, soil compaction, nutrient loss
Management considerations:
• Water erosion can be controlled by diversions, crop residue management, contour stripcropping, field stripcropping, cover crops, grassed waterways, conservation tillage, crop rotations that include grasses and legumes, grade-stabilization structures, or a combination of these.
• Growing grasses and legumes for pasture or hay is effective in controlling erosion.
• Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, permeability, and the rate of water infiltration.
• Minimizing tillage and tilling at the proper soil moisture content help to maintain good tilth.
• Crop rotations and the use of legumes may reduce the need for commercial fertilizer. Sod-based rotations significantly reduce dissolved and particulate nitrogen and phosphorus losses by minimizing runoff losses.

Pasture

Major management concerns: Erosion hazard, compaction
Management considerations:
• Restricted grazing during wet periods helps to prevent compaction and poor tilth.
• Proper stocking rates and short-duration grazing during the summer help to control water erosion, maintain plant density and hardiness, and help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: Equipment limitation, windthrow hazard, plant competition
Management considerations:
• Because of the very slow permeability and the sticky and plastic subsoil, logging roads should be graveled and, in some areas, landings should be stabilized.
• Skidders should not be used during wet periods, when ruts form easily.

• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Species preference can be managed by selective cutting.

Buildings

Major management concerns: Shrink-swell, slope
Management considerations:
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Land shaping may be necessary to develop a suitable building site.

Septic tank absorption fields

Major management concerns: Very slow permeability, slope
Management considerations:
• Increasing the size of the absorption area helps to compensate for the restricted permeability.
• Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 3L
Michigan soil management group: 1a

110F—Negwegon silt loam, 25 to 45 percent slopes

Setting

Landform: Escarpments and ridges on dissected lake plains
Shape of areas: Irregular
Size of areas: 5 to 40 acres

Typical Profile

Surface layer:
0 to 1 inch—very dark grayish brown silt loam

Subsurface layer:
1 to 4 inches—brown silt loam

Subsoil:
4 to 16 inches—reddish brown silty clay loam and brown silt loam
16 to 40 inches—reddish brown silty clay

Substratum:
40 to 60 inches—stratified brown silty clay loam and yellowish brown silt loam

Soil Properties and Qualities

Permeability: Very slow
Available water capacity: High
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Very rapid
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Severe
Hazard of soil blowing: Slight
Shrink-swell potential: High

Composition

Negwegon and similar soils: About 95 percent
Contrasting inclusions: About 5 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Algonquin soils in drainageways

Similar inclusions:
• Soils that have a thin surface layer of very fine sandy loam

Use and Management

Land use: Dominant use—woodland

Woodland

Major management concerns: Equipment limitation, erosion hazard, windthrow hazard, plant competition
Management considerations:
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• In the steepest areas, cable yarding systems are generally safer than other logging methods and result in less surface disturbance.
• The grade should be kept as low as possible.
• Because of the very slow permeability and the sticky and plastic subsoil, logging roads should be graveled and, in some areas, landings should be stabilized.
• Skidders should not be used during wet periods, when ruts form easily.
• Because of the erosion hazard, water should be

removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
• Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced.
• After cutting, competition from brush can delay or prevent the natural regeneration of desired species.
• Species preference can be managed by selective cutting.

Buildings

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope
Management considerations:
• Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 3R
Michigan soil management group: 1a

111B—Manistee loamy sand, moderately wet, 0 to 6 percent slopes

Setting

Landform: Lake plains and outwash plains
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 4 inches—black loamy sand

Subsurface layer:
4 to 6 inches—pinkish gray loamy sand

Subsoil:
6 to 24 inches—strong brown loamy sand
24 to 27 inches—reddish brown clay and pinkish gray, mottled sandy loam
27 to 32 inches—reddish brown, mottled clay
32 to 50 inches—reddish brown clay

Substratum:
50 to 60 inches—reddish brown clay

Soil Properties and Qualities

Permeability: Rapid in the upper part; very slow in the lower part
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Perched at a depth of 2.5 to 4.0 feet from November through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper part and high in the lower part

Composition

Manistee and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Allendale soils in the lower positions on the landscape
• The very poorly drained Wakeley soils in depressions and drainageways

Similar inclusions:
• Soils that are well drained

Use and Management

Land use: Dominant uses—woodland, pasture; other uses—cropland, building sites

Cropland

Major management concerns: Soil blowing, nutrient loss, low organic matter content, seasonal wetness
Management considerations:
• Conservation tillage, vegetative barriers, and cover crops help to control soil blowing.
• Timing fertilizer applications so that they meet the nutrient needs of the crop, using split fertilizer applications, and applying fertilizer in bands may reduce the risk of nutrient leaching.
• Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and can help to prevent ground-water pollution.
• Including green manure crops in the cropping sequence, using no-till planting, and managing crop residue increase the organic matter content.
• Subsurface drains can reduce the wetness if a suitable outlet is available.

Pasture

Major management concerns: Overgrazing, seasonal wetness
Management considerations:
• Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to soil tests helps to ensure the maximum growth of plants, especially legumes.

Woodland

Major management concerns: None

Buildings

Major management concerns: Cutbanks cave, shrink-swell, seasonal wetness
Management considerations:
• Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
• Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
• Wetness can be reduced by installing a drainage system around structures that have basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Seasonal wetness, slow permeability, poor filtering capacity
Management considerations:
• The poor filtering capacity can result in the pollution of ground water.
• Mounding or adding suitable fill material helps to raise the absorption field above the water table and increases the thickness of the filtering material.
• Increasing the size of the absorption area helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: 3A
Michigan soil management group: 4/1a

209B—Grayling sand, calcareous substratum, nearly level and undulating

Setting

Landform: Deltas and river terraces
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 200 to 2,000 acres

Reference Profile

Surface layer:
0 to 2 inches—black sand

Subsoil:
2 to 4 inches—dark yellowish brown sand
4 to 29 inches—yellowish brown sand

Substratum:
29 to 70 inches—light yellowish brown sand
70 to 180 inches—yellowish brown, calcareous sand that has strata of fine sand, coarse sand, or gravelly sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Grayling and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Haplaquods, Alfic Haplaquods, and Au Gres soils and the very poorly drained, dysic Borosaprists; in depressions

Similar inclusions:
• Sandy soils that have a banded substratum
• Sandy soils that have a gray subsurface layer
• Sandy soils that are moderately well drained

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.7a

Primary plant association: Black oak-White oak-Blueberry
Secondary plant association: Mixed oak-Red maple-Starflower

210B—Grayling sand, nearly level and undulating

Setting

Landform: Outwash plains
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 80 to 600 acres

Reference Profile

Surface layer:
0 to 2 inches—black sand

Subsoil:
2 to 4 inches—dark yellowish brown sand
4 to 29 inches—yellowish brown sand

Substratum:
29 to 180 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Grayling and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Haplaquods, Alfic Haplaquods, and Au Gres soils and the very poorly drained, dysic Borosaprists; in depressions

Similar inclusions:
• Sandy soils that have a banded substratum
• Sandy soils that have a gray subsurface layer
• Sandy soils that are moderately well drained

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.7a
Primary plant association: Black oak-White oak-Blueberry
Secondary plant association: Mixed oak-Red maple-Starflower

210C—Grayling sand, rolling

Setting

Landform: Outwash plains and overwashed moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 2 inches—black sand

Subsoil:
2 to 4 inches—dark yellowish brown sand
4 to 29 inches—yellowish brown sand

Substratum:
29 to 180 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Grayling and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• Alfic Haplorthods, sandy, and Entic Haplorthods, sandy, loamy substratum, which are more fertile than

the Grayling soil; in landscape positions similar to those of the Grayling soil

Similar inclusions:
- Sandy soils that have deep bands
- Sandy soils that have a gray subsurface layer
- Sandy soils that are moderately well drained

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
- Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate.
- The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.7a
Primary plant association: Black oak-White oak-Blueberry
Secondary plant association: Mixed oak-Red maple-Starflower

210D—Grayling sand, hilly

Setting

Landform: Overwashed sandy moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 2 inches—black sand

Subsoil:
2 to 4 inches—dark yellowish brown sand
4 to 29 inches—yellowish brown sand

Substratum:
29 to 180 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe

Composition

Grayling and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
- Alfic Haplorthods, sandy, and Entic Haplorthods, sandy, loamy substratum, which are more fertile than the Grayling soil; in landscape positions similar to those of the Grayling soil

Similar inclusions:
- Sandy soils that have deep bands
- Sandy soils that have a gray subsurface layer
- Sandy soils that are moderately well drained
- Sandy soils that have gravelly textures in the substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
- Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
- Because of the hazard of erosion, the use of logging equipment and the construction of roads in steep areas should be avoided.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Planting when the soil is moist can reduce the seedling mortality rate.
- The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4R
Michigan soil management group: 5.7a
Primary plant association: Black oak-White oak-Blueberry
Secondary plant association: Mixed oak-Red maple-Starflower

211B—Grayling sand, banded substratum, nearly level and undulating

Setting

Landform: Outwash plains
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 80 to 600 acres

Reference Profile

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 15 inches—dark yellowish brown sand
15 to 35 inches—yellowish brown sand

Substratum:
35 to 60 inches—light yellowish brown sand
60 to 80 inches—light yellowish brown sand and bands of yellowish brown loamy sand
80 to 180 inches—light yellowish brown sand that has strata of fine sand, coarse sand, or loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Grayling and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils and Alfic Haplaquods, the poorly drained Leafriver and Wakeley soils, and the very poorly drained, dysic Borosaprists; in depressions
• Entic Haplorthods, sandy, loamy substratum, in landscape positions similar to those of the Grayling soil

Similar inclusions:
• Sandy soils that are not banded
• Sandy soils that have a gray subsurface layer
• Sandy soils that are moderately well drained
• Sandy soils that have gravelly textures in the substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.7a
Primary plant association: Black oak-White oak-Blueberry
Secondary plant association: Mixed oak-Red maple-Starflower

211C—Grayling sand, banded substratum, rolling

Setting

Landform: Rolling areas on overwashed moraines and ice-contact moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 80 to 600 acres

Reference Profile

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 15 inches—dark yellowish brown sand
15 to 35 inches—yellowish brown sand

Substratum:
35 to 60 inches—light yellowish brown sand
60 to 80 inches—light yellowish brown sand and bands of yellowish brown loamy sand
80 to 180 inches—light yellowish brown sand that has strata of fine sand, coarse sand, or loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet

Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Grayling and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils and Alfic Haplaquods, the poorly drained Leafriver and Wakeley soils, and the very poorly drained, dysic Borosaprists; in depressions
• Entic Haplorthods, sandy, loamy substratum
• Alfic Haplorthods, sandy, in landscape positions similar to those of the Grayling soil

Similar inclusions:
• Sandy soils that are not banded
• Sandy soils that have a gray subsurface layer
• Sandy soils that are moderately well drained
• Sandy soils that have gravelly textures in the substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.7a
Primary plant association: Black oak-White oak-Blueberry
Secondary plant association: Mixed oak-Red maple-Starflower

212B—Grayling sand, very deep water table, nearly level and undulating

Setting

Landform: Outwash plains
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 80 to 600 acres

Reference Profile

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 10 inches—dark yellowish brown sand
10 to 30 inches—yellowish brown sand

Substratum:
30 to 70 inches—light yellowish brown sand
70 to 100 inches—light yellowish brown, mottled sand
100 to 180 inches—yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: 6 to 15 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Grayling and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils and Alfic Haplaquods, the poorly drained Leafriver and Wakeley soils, and the very poorly drained, dysic Borosaprists; in depressions

Similar inclusions:
• Sandy soils that have deep bands
• Sandy soils that have a gray subsurface layer
• Sandy soils that are moderately well drained
• Sandy soils that have a water table below a depth of 15 feet
• Sandy soils that have gravelly textures in the substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.7a
Primary plant association: Black oak-White oak-Blueberry
Secondary plant association: Mixed oak-Red maple-Starflower

213B—Graycalm sand, nearly level and undulating

Setting

Landform: Outwash plains and overwashed moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 80 to 400 acres

Reference Profile

Surface layer:
0 to 1 inch—black sand

Subsoil:
1 to 4 inches—strong brown sand
4 to 46 inches—strong brown loamy sand
46 to 70 inches—light yellowish brown sand that has bands of brown loamy sand

Substratum:
70 to 180 inches—stratified coarse sand to loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Graycalm and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils and Alfic Haplaquods and the very poorly drained, dysic Borosaprists; in depressions

Similar inclusions:
• Sandy soils that have a gray subsurface horizon
• Sandy soils that are moderately well drained
• Sandy soils that have spodic development
• Sandy soils that have a banded substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 6S
Michigan soil management group: 5a
Primary plant association: Black oak-White oak-Blueberry
Secondary plant association: Mixed oak-Red maple-Starflower

213C—Graycalm sand, rolling

Setting

Landform: Ice-contact moraines and overwashed moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 80 to 400 acres

Reference Profile

Surface layer:
0 to 1 inch—black sand

Subsoil:
1 to 4 inches—strong brown sand
4 to 46 inches—strong brown loamy sand

46 to 70 inches—light yellowish brown sand that has bands of brown loamy sand

Substratum:
70 to 180 inches—stratified coarse sand to loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Graycalm and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils and Alfic Haplaquods and the very poorly drained, dysic Borosaprists; in depressions

Similar inclusions:
• Sandy soils that have a gray subsurface layer
• Sandy soils that are moderately well drained
• Sandy soils that have spodic development
• Sandy soils that have a gravelly substratum
• Sandy soils that have a banded substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 6S
Michigan soil management group: 5a
Primary plant association: Black oak-White oak-Blueberry
Secondary plant association: Mixed oak-Red maple-Starflower

215C—Typic Udipsamments, loamy substratum, rolling

Setting

Landform: Outwash plains and overwashed moraines
Slope: 0 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark grayish brown sand

Subsoil:
2 to 15 inches—dark yellowish brown sand
15 to 25 inches—yellowish brown sand

Substratum:
25 to 75 inches—brownish yellow sand
75 to 95 inches—strong brown sandy clay loam

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Well drained
Depth to the water table: More than 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils and Alfic Haplaquods, the poorly drained Leafriver and Wakeley soils, and the very poorly drained, dysic Borosaprists; in depressions and drainageways
• Alfic Haplorthods, sandy, and Glossic Eutroboralfs; in landscape positions similar to those of the Typic Udipsamments

Similar inclusions:
• Sandy soils that are moderately well drained
• Sandy soils that have a coarse textured substratum

• Sandy soils that have a surface layer of loamy sand or fine sand
• Sandy soils that have a banded substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Black oak-White oak-Blueberry
Secondary plant association: Mixed oak-Red maple-Starflower

220B—Typic Udipsamments, nearly level and undulating

Setting

Landform: Sandy moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—light brownish gray sand

Subsoil:
4 to 12 inches—dark yellowish brown sand
12 to 40 inches—yellowish brown sand

Substratum:
40 to 180 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils and Alfic Haplaquods, the very poorly drained Leafriver and Wakeley soils, and the very poorly drained, dysic Borosaprists; in depressions and drainageways
• The well drained Glossic Eutroboralfs in landscape positions similar to those of the Typic Udipsamments

Similar inclusions:
• Sandy soils that are moderately well drained
• Sandy soils that have a fine textured substratum
• Sandy soils that have a surface layer of loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Black oak-White oak-Blueberry

220C—Typic Udipsamments, rolling

Setting

Landform: Sandy moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—light brownish gray sand

Subsoil:
4 to 12 inches—strong brown sand
12 to 40 inches—brownish yellow sand

Substratum:
40 to 180 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils and Alfic Haplaquods, the poorly drained Leafriver and Wakeley soils, and the very poorly drained, dysic Borosaprists; in depressions and drainageways
• The well drained Glossic Eutroboralfs, fine-loamy, in landscape positions similar to those of the Typic Udipsamments

Similar inclusions:
• Sandy soils that are moderately well drained
• Sandy soils that have a fine textured substratum
• Sandy soils that have a surface layer of loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Black oak-White oak-Blueberry

220D—Typic Udipsamments, hilly

Setting

Landform: Sandy moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—light brownish gray sand

Subsoil:
4 to 12 inches—yellowish brown sand
12 to 40 inches—brownish yellow sand

Substratum:
40 to 180 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• Glossic Eutroboralfs in landscape positions similar to those of the Typic Udipsamments

Similar inclusions:
• Sandy soils that have a banded substratum
• Sandy soils that have a surface layer of loamy sand or fine sand
• Sandy soils that have a gravelly substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, steep slopes
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Special care is needed in laying out logging roads and in operating logging equipment. The hazard of erosion can be reduced by seeding logging roads and landings and by installing water bars and culverts.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Black oak-White oak-Blueberry

220E—Typic Udipsamments, steep

Setting

Landform: Sandy moraines
Slope: 30 to 50 percent
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—light brownish gray sand

Subsoil:
4 to 12 inches—yellowish brown sand
12 to 40 inches—brownish yellow sand

Substratum:
40 to 180 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Rapid
Flooding: None
Organic matter content: Low
Hazard of water erosion: Severe
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• Alfic Haplorthods, sandy over loamy, and Glossic Eutroboralfs; in landscape positions similar to those of the Typic Udipsamments

Similar inclusions:
• Sandy soils that have a fine textured, banded substratum
• Sandy soils that have a surface layer of loamy sand or fine sand
• Sandy soils that have a gravelly substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced, management practices that disturb the soil should be avoided in the steep areas.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Black oak-White oak-Blueberry

221B—Typic Udipsamments, banded substratum, nearly level and undulating

Setting

Landform: Sandy moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsoil:
3 to 6 inches—dark brown sand
6 to 20 inches—strong brown sand
20 to 30 inches—brownish yellow sand

Substratum:
30 to 45 inches—light yellowish brown sand
45 to 75 inches—light yellowish brown sand that has bands of dark yellowish brown loamy sand
75 to 85 inches—brown loamy sand
85 to 180 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Au Gres soils and Alfic Haplaquods, the poorly drained Leafriver and Wakeley soils, and the very poorly drained, dysic Borosaprists; in depressions and drainageways
- Glossic Eutoboralfs and Alfic Haplorthods, sandy over loamy; in landscape positions similar to those of the Typic Udipsamments

Similar inclusions:
- Sandy soils that are moderately well drained
- Sandy soils that have a fine textured, banded substratum
- Sandy soils that have a surface layer of loamy sand or fine sand
- Sandy soils that have a gravelly substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
- Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Black oak-White oak-Blueberry

221C—Typic Udipsamments, banded substratum, rolling

Setting

Landform: Sandy moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsoil:
3 to 6 inches—dark brown sand
6 to 20 inches—strong brown sand
20 to 30 inches—brownish yellow sand

Substratum:
30 to 45 inches—light yellowish brown sand
45 to 75 inches—light yellowish brown sand that has bands of dark yellowish brown loamy sand
75 to 85 inches—brown loamy sand
85 to 180 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils, the poorly drained Leafriver and Wakeley soils, and the very poorly drained, dysic Borosaprists; in depressions and drainageways
• Glossic Eutroboralfs and Alfic Haplorthods, sandy over loamy; in landscape positions similar to those of the Typic Udipsamments

Similar inclusions:
• Sandy soils that are moderately well drained
• Sandy soils that have a fine textured, banded substratum
• Sandy soils that have a surface layer of loamy sand or fine sand
• Sandy soils that have a gravelly substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Black oak-White oak-Blueberry

221D—Typic Udipsamments, banded substratum, hilly

Setting

Landform: Sandy moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsoil:
3 to 6 inches—dark brown sand
6 to 20 inches—strong brown sand
20 to 30 inches—brownish yellow sand

Substratum:
30 to 45 inches—light yellowish brown sand
45 to 75 inches—light yellowish brown sand that has bands of dark yellowish brown loamy sand
75 to 85 inches—brown loamy sand
85 to 180 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• Alfic Haplorthods, sandy over loamy, and Entic Haplorthods, sandy, loamy substratum; in landscape positions similar to those of the Typic Udipsamments

Similar inclusions:
• Sandy soils that have a fine textured, banded substratum

• Sandy soils that have a surface layer of loamy sand or fine sand
• Sandy soils that have a gravelly substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Special care is needed in laying out logging roads and in operating logging equipment. The hazard of erosion can be reduced by seeding logging roads and landings and by installing water bars and culverts.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Black oak-White oak-Blueberry

222B—Typic Udipsamments, very deep water table, nearly level and undulating

Setting

Landform: Outwash plains
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsoil:
2 to 5 inches—dark brown sand
5 to 15 inches—strong brown sand
15 to 30 inches—yellowish brown sand

Substratum:
30 to 80 inches—light yellowish brown, mottled sand
80 to 90 inches—yellowish brown, mottled sand
90 to 100 inches—yellowish brown, saturated sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: 5 to 10 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils and Alfic Haplaquods, the poorly drained Leafriver and Wakeley soils, and the very poorly drained, dysic Borosaprists; in depressions and drainageways

Similar inclusions:
• Sandy soils that have a fine textured substratum
• Sandy soils that have a surface layer of loamy sand or fine sand
• Sandy soils that do not have a mottled substratum
• Sandy soils that have a gravelly substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Black oak-White oak-Blueberry

223B—Graycalm-Grayling sands, nearly level and undulating

Setting

Landform: Sandy ground moraines and end moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Graycalm

Surface layer:
0 to 1 inch—black sand

Subsoil:
1 to 4 inches—strong brown sand
4 to 46 inches—strong brown loamy sand
46 to 70 inches—light yellowish brown sand that has bands of brown loamy sand

Substratum:
70 to 180 inches—stratified coarse sand to loamy sand

Grayling

Surface layer:
0 to 2 inches—black sand

Subsoil:
2 to 4 inches—dark yellowish brown sand
4 to 29 inches—yellowish brown sand

Substratum:
29 to 180 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Graycalm and Grayling soils and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils and sandy Alfic Haplaquods, the poorly drained Leafriver and Wakeley soils, and the very poorly drained, dysic Borosaprists; in depressions and drainageways

Similar inclusions:
• Sandy soils that are moderately well drained
• Sandy soils that do not have bands in the substratum
• Sandy soils that have a surface layer of loamy sand or fine sand
• Sandy soils that have gravelly textures in the substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: Graycalm—6S; Grayling—4S
Michigan soil management group: Graycalm—5a; Grayling—5.7a
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Black oak-White oak-Blueberry

223C—Graycalm-Grayling sands, rolling

Setting

Landform: Sandy ground moraines and end moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Graycalm

Surface layer:
0 to 1 inch—black sand

Subsoil:
1 to 4 inches—strong brown sand
4 to 46 inches—strong brown loamy sand
46 to 70 inches—light yellowish brown sand that has bands of brown loamy sand

Substratum:
70 to 180 inches—stratified coarse sand to loamy sand

Grayling

Surface layer:
0 to 2 inches—black sand

Subsoil:
2 to 4 inches—dark yellowish brown sand
4 to 29 inches—yellowish brown sand

Substratum:
29 to 180 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Graycalm and Grayling soils and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils and Alfic Haplaquods, the poorly drained Leafriver and Wakeley soils, and the very poorly drained, dysic Borosaprists; in depressions and drainageways
• Alfic Haplorthods, sandy over loamy, and Glossic Eutroboralfs; in landscape positions similar to those of the Graycalm and Grayling soils

Similar inclusions:
• Sandy soils that are moderately well drained
• Sandy soils that have a gravelly substratum
• Sandy soils that have a surface layer of loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: Graycalm—6S; Grayling—4S
Michigan soil management group: Graycalm—5a; Grayling—5.7a
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Black oak-White oak-Blueberry

223D—Graycalm-Grayling sands, hilly

Setting

Landform: Sandy ground moraines and end moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Graycalm

Surface layer:
0 to 1 inch—black sand

Subsoil:
1 to 4 inches—strong brown sand
4 to 46 inches—strong brown loamy sand
46 to 70 inches—light yellowish brown sand that has bands of brown loamy sand

Substratum:
70 to 180 inches—stratified coarse sand to loamy sand

Grayling

Surface layer:
0 to 2 inches—black sand

Subsoil:
2 to 4 inches—dark yellowish brown sand
4 to 29 inches—yellowish brown sand

Substratum:
29 to 180 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained

Depth to the water table: More than 15 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe

Composition

Graycalm and Grayling soils and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
• Alfic Haplorthods, sandy over loamy, and Glossic Eutroboralfs; in landscape positions similar to those of the Graycalm and Grayling soils

Similar inclusions:
• Sandy soils that have coarse textured bands in the substratum
• Sandy soils that have a surface layer of loamy sand or fine sand
• Sandy soils that have a gravelly substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Special care is needed in laying out logging roads and in operating logging equipment. The hazard of erosion can be reduced by seeding logging roads and landings and by installing water bars and culverts.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: Graycalm—6R; Grayling—4R
Michigan soil management group: Graycalm—5a; Grayling—5.7a
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Black oak-White oak-Blueberry

224B—Croswell sand, nearly level and undulating

Setting

Landform: Outwash plains
Slope: 0 to 4 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Organic mat:
0 to 1 inch—black, well decomposed forest leaf litter

Surface layer:
1 to 4 inches—dark grayish brown sand

Subsoil:
4 to 10 inches—dark brown sand
10 to 20 inches—strong brown sand
20 to 29 inches—brownish yellow, mottled sand

Substratum:
29 to 80 inches—yellowish brown and light yellowish brown, mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Moderately well drained
Depth to the water table: 3 to 5 feet from October through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Croswell and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• The poorly drained Leafriver and Wakeley soils, the somewhat poorly drained Alfic Haplaquods, and the very poorly drained, dysic Borosaprists; in depressions and drainageways

Similar inclusions:
• Sandy soils that have a banded substratum
• Sandy soils that have a surface layer of loamy sand
• Sandy soils that do not have a mottled substratum
• Sandy soils that are moderately well drained

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 5S
Michigan soil management group: 5a
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Black oak-White oak-Blueberry

225B—Entic Haplorthods, sandy, loamy substratum, nearly level and undulating

Setting

Landform: Overwashed sandy moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—grayish brown sand

Subsoil:
4 to 8 inches—dark brown sand
8 to 15 inches—dark yellowish brown sand
15 to 30 inches—yellowish brown sand

Substratum:
30 to 55 inches—strong brown sand
55 to 80 inches—reddish brown sandy clay loam

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Well drained
Depth to the water table: More than 15 feet
Surface runoff: Very slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils and Alfic Haplaquods, the poorly drained Leafriver and Wakeley soils, and the very poorly drained, dysic Borosaprists; in depressions and drainageways
• Glossic Eutroboralfs in landscape positions similar to those of the Entic Haplorthods

Similar inclusions:
• Sandy soils that are moderately well drained
• Sandy soils that have a coarse textured substratum
• Sandy soils that have a surface layer of loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Northern red oak-Red maple-Mapleleaf viburnum

225C—Entic Haplorthods, sandy, loamy substratum, rolling

Setting

Landform: Overwashed end moraines and ground moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—grayish brown sand

Subsoil:
4 to 8 inches—dark brown sand
8 to 15 inches—strong brown sand
15 to 30 inches—yellowish brown sand

Substratum:
30 to 55 inches—strong brown sand
55 to 80 inches—reddish brown sandy clay loam

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Well drained
Depth to the water table: More than 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils and Alfic Haplaquods, the poorly drained Leafriver and Wakeley soils, and the very poorly drained, dysic Borosaprists; in depressions and drainageways
• Glossic Eutroboralfs in landscape positions similar to those of the Entic Haplorthods

Similar inclusions:
• Sandy soils that are moderately well drained
• Sandy soils that have a coarse textured substratum
• Sandy soils that have a surface layer of loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Mixed oak-Red maple-Starflower
Secondary plant association: Northern red oak-Red maple-Mapleleaf viburnum

230C—Entic Haplorthods, sandy-Alfic Haplorthods, sandy, complex, rolling

Setting

Landform: Sandy moraines
Slope: 0 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Entic Haplorthods

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—pale brown sand

Subsoil:
4 to 8 inches—dark brown sand
8 to 20 inches—strong brown sand
20 to 35 inches—reddish yellow sand

Substratum:
35 to 180 inches—light yellowish brown sand

Alfic Haplorthods

Organic mat:
0 to 2 inches—partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark gray loamy sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 10 inches—dark brown loamy sand
10 to 17 inches—strong brown sand
17 to 37 inches—yellowish brown sand
37 to 42 inches—dark brown sandy loam

Substratum:
42 to 77 inches—reddish yellow sand
77 to 180 inches—brownish yellow sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate or severe

Composition

Entic Haplorthods and similar soils: 40 to 70 percent
Alfic Haplorthods and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 30 percent

Inclusions

Contrasting inclusions:
• The poorly drained Leafriver and Wakeley soils and the very poorly drained, dysic and euic Borosaprists; in depressions and drainageways

Similar inclusions:
• Sandy soils that have a fine textured substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Mapleleaf viburnum
Secondary plant association: Mixed oak-Red maple-Starflower

231B—Entic Haplorthods, sandy, banded substratum-Alfic Haplorthods, sandy, complex, nearly level and undulating

Setting

Landform: Sandy moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Entic Haplorthods

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—brown sand

Subsoil:
4 to 8 inches—dark brown sand
8 to 20 inches—strong brown sand
20 to 30 inches—brownish yellow sand

Substratum:
30 to 60 inches—light yellowish brown sand
60 to 75 inches—light yellowish brown sand that has bands of dark yellowish brown loamy sand
75 to 85 inches—brown loamy sand
85 to 180 inches—light yellowish brown sand

Alfic Haplorthods

Organic mat:
0 to 2 inches—partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark gray loamy sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 10 inches—dark brown loamy sand
10 to 17 inches—strong brown sand
17 to 37 inches—yellowish brown sand
37 to 42 inches—dark brown sandy loam

Substratum:
42 to 77 inches—reddish yellow sand
77 to 180 inches—brownish yellow sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low

Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate or severe

Composition

Entic Haplorthods and similar soils: 40 to 70 percent
Alfic Haplorthods and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 30 percent

Inclusions

Contrasting inclusions:
• The poorly drained Leafriver and Wakeley soils and the very poorly drained, dysic and euic Borosaprists; in depressions and drainageways

Similar inclusions:
• Sandy soils that have a loamy substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Mapleleaf viburnum
Secondary plant association: Mixed oak-Red maple-Starflower

231C—Entic Haplorthods, sandy, banded substratum-Alfic Haplorthods, sandy, complex, rolling

Setting

Landform: Sandy end moraines and ground moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Entic Haplorthods

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—brown sand

Subsoil:
4 to 8 inches—dark brown sand
8 to 20 inches—strong brown sand
20 to 30 inches—brownish yellow sand

Substratum:
30 to 60 inches—light yellowish brown sand
60 to 75 inches—light yellowish brown sand that has bands of dark yellowish brown loamy sand
75 to 85 inches—brown loamy sand
85 to 180 inches—light yellowish brown sand

Alfic Haplorthods

Organic mat:
0 to 2 inches—partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark gray loamy sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 10 inches—dark brown loamy sand
10 to 17 inches—strong brown sand
17 to 37 inches—yellowish brown sand
37 to 42 inches—dark brown sandy loam

Substratum:
42 to 77 inches—reddish yellow sand
77 to 180 inches—brownish yellow sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate or severe

Composition

Entic Haplorthods and similar soils: 40 to 70 percent
Alfic Haplorthods and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 30 percent

Inclusions

Contrasting inclusions:
• The poorly drained Leafriver and Wakeley soils and the very poorly drained, euic and dysic Borosaprists; in depressions and drainageways

Similar inclusions:
• Sandy soils that have a loamy substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Mapleleaf viburnum
Secondary plant association: Mixed oak-Red maple-Starflower

231D—Entic Haplorthods, sandy, banded substratum-Alfic Haplorthods, sandy, complex, hilly

Setting

Landform: Sandy end moraines and ground moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Entic Haplorthods

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—brown sand

Subsoil:
4 to 8 inches—dark brown sand
8 to 20 inches—strong brown sand
20 to 30 inches—brownish yellow sand

Substratum:
30 to 60 inches—light yellowish brown sand
60 to 75 inches—light yellowish brown sand that has bands of dark yellowish brown loamy sand
75 to 85 inches—brown loamy sand
85 to 180 inches—light yellowish brown sand

Alfic Haplorthods

Organic mat:
0 to 2 inches—partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark gray loamy sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 10 inches—dark brown loamy sand
10 to 17 inches—strong brown sand
17 to 37 inches—yellowish brown sand
37 to 42 inches—dark brown sandy loam

Substratum:
42 to 77 inches—reddish yellow sand
77 to 180 inches—brownish yellow sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate or severe

Composition

Entic Haplorthods and similar soils: 40 to 70 percent
Alfic Haplorthods and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 30 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Alfic Haplaquods and the very poorly drained, dysic and euic Borosaprists; in depressions and drainageways

Similar inclusions:
• Sandy soils that have a loamy substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Management practices that disturb the soil should be limited in steep areas. Special care is needed in the placement of roads and trails.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Mapleleaf viburnum
Secondary plant association: Mixed oak-Red maple-Starflower

232B—Entic Haplorthods, sandy-Alfic Haplorthods, sandy, complex, very deep water table, nearly level and undulating

Setting

Landform: Outwash
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 100 acres

Reference Profile

Entic Haplorthods

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 3 inches—grayish brown sand

Subsoil:
3 to 7 inches—dark brown sand
7 to 15 inches—strong brown sand
15 to 30 inches—yellowish brown sand

Substratum:
30 to 80 inches—light yellowish brown, mottled sand
80 to 90 inches—yellowish brown, mottled sand
90 to 100 inches—yellowish brown, saturated sand

Alfic Haplorthods

Organic mat:
0 to 2 inches—partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark gray loamy sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 10 inches—dark brown loamy sand
10 to 17 inches—strong brown sand
17 to 37 inches—yellowish brown sand
37 to 42 inches—dark brown sandy loam

Substratum:
42 to 70 inches—reddish yellow, mottled sand
70 to 100 inches—brownish yellow, saturated sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: 6 to 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate or severe

Composition

Entic Haplorthods and similar soils: 40 to 70 percent
Alfic Haplorthods and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 30 percent

Inclusions

Contrasting inclusions:
• The poorly drained Leafriver and Wakeley soils and the very poorly drained, dysic and euic Borosaprists; in depressions and drainageways

Similar inclusions:
• Sandy soils that have a loamy substratum
• Sandy soils that have a water table at a depth of more than 6 feet
• Sandy soils that have a banded substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Mapleleaf viburnum
Secondary plant association: Mixed oak-Red maple-Starflower

233B—Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine-loamy banded substratum, complex, nearly level and undulating

Setting

Landform: Sandy moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Alfic Haplorthods

Organic mat:
0 to 2 inches—partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark gray loamy sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 10 inches—dark brown loamy sand
10 to 17 inches—strong brown sand
17 to 37 inches—yellowish brown sand
37 to 42 inches—dark brown sandy loam

Substratum:
42 to 77 inches—reddish yellow sand
77 to 180 inches—brownish yellow sand

Entic Haplorthods

Surface layer:
0 to 2 inches—dark grayish brown sand

Subsurface layer:
2 to 3 inches—pale brown sand

Subsoil:
3 to 6 inches—dark brown sand
6 to 15 inches—strong brown sand
15 to 30 inches—yellowish brown sand
30 to 55 inches—light yellowish brown sand

Substratum:
55 to 70 inches—yellowish brown sand that has bands of sandy clay loam
70 to 180 inches—light yellowish brown, stratified sands

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate or severe

Composition

Alfic Haplorthods and similar soils: 40 to 75 percent
Entic Haplorthods and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 20 percent

Inclusions

Contrasting inclusions:
• The poorly drained Leafriver and Wakeley soils and the very poorly drained, euic Borosaprists; in depressions and drainageways

Similar inclusions:
• Sandy soils that do not have a fine-loamy substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Mapleleaf viburnum
Secondary plant association: Mixed oak-Red maple-Starflower

233C—Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine-loamy banded substratum, complex, rolling

Setting

Landform: Sandy moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Reference Profile

Alfic Haplorthods

Organic mat:
0 to 2 inches—partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark gray loamy sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 10 inches—dark brown loamy sand
10 to 17 inches—strong brown sand
17 to 37 inches—yellowish brown sand
37 to 42 inches—dark brown sandy loam

Substratum:
42 to 77 inches—reddish yellow sand
77 to 180 inches—brownish yellow sand

Entic Haplorthods

Surface layer:
0 to 2 inches—dark grayish brown sand

Subsurface layer:
2 to 3 inches—pale brown sand

Subsoil:
3 to 6 inches—dark brown sand
6 to 15 inches—strong brown sand
15 to 30 inches—yellowish brown sand
30 to 55 inches—light yellowish brown sand

Substratum:
55 to 70 inches—yellowish brown sand that has bands of sandy clay loam
70 to 180 inches—light yellowish brown, stratified sands

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate or severe

Composition

Alfic Haplorthods and similar soils: 40 to 75 percent
Entic Haplorthods and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 20 percent

Inclusions

Contrasting inclusions:
- The poorly drained Leafriver and Wakeley soils and the very poorly drained, euic Borosaprists; in depressions and drainageways

Similar inclusions:
- Sandy soils that do not have a fine-loamy substratum
- Sandy soils that do not have a dark brown subsoil

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
- Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate.
- The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Mapleleaf viburnum
Secondary plant association: Mixed oak-Red maple-Starflower

233D—Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine-loamy banded substratum, complex, hilly

Setting

Landform: Sandy moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Reference Profile

Alfic Haplorthods

Organic mat:
0 to 2 inches—partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark gray loamy sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 10 inches—dark brown loamy sand
10 to 17 inches—strong brown sand
17 to 37 inches—yellowish brown sand
37 to 42 inches—dark brown sandy loam

Substratum:
42 to 77 inches—reddish yellow sand
77 to 180 inches—brownish yellow sand

Entic Haplorthods

Surface layer:
0 to 2 inches—dark grayish brown sand

Subsurface layer:
2 to 3 inches—pale brown sand

Subsoil:
3 to 6 inches—dark brown sand
6 to 15 inches—strong brown sand
15 to 30 inches—yellowish brown sand
30 to 55 inches—light yellowish brown sand

Substratum:
55 to 70 inches—yellowish brown sand that has bands of sandy clay loam
70 to 180 inches—light yellowish brown, stratified sands

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate or severe

Composition

Alfic Haplorthods and similar soils: 40 to 75 percent
Entic Haplorthods and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 20 percent

Inclusions

Contrasting inclusions:
• The poorly drained Leafriver and Wakeley soils and the very poorly drained, euic Borosaprists; in depressions and drainageways

Similar inclusions:
• Sandy soils that do not have a fine-loamy substratum
• Sandy soils that do not have a dark brown subsoil

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• Management practices that disturb the soil should be limited in steep areas. Special care is needed in the placement of roads and trails.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Mapleleaf viburnum
Secondary plant association: Mixed oak-Red maple-Starflower

235B—Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy, complex, nearly level and undulating

Setting

Landform: Sandy end moraines and ground moraines
Slope: 0 to 6 percent

Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Alfic Haplorthods, sandy over loamy

Organic mat:
0 to 2 inches—black, partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark grayish brown sand

Subsurface layer:
4 to 6 inches—grayish brown sand

Subsoil:
6 to 9 inches—dark brown loamy sand
9 to 27 inches—strong brown sand
27 to 44 inches—brown sandy clay loam

Substratum:
44 to 52 inches—yellowish brown loamy sand
52 to 120 inches—brownish yellow sand

Alfic Haplorthods, sandy

Organic mat:
0 to 2 inches—partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark gray loamy sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 10 inches—dark brown loamy sand
10 to 17 inches—strong brown sand
17 to 37 inches—yellowish brown sand
37 to 42 inches—dark brown sandy loam

Substratum:
42 to 77 inches—reddish yellow sand
77 to 180 inches—brownish yellow sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate or severe

Composition

Alfic Haplorthods, sandy over loamy, and similar soils: 40 to 70 percent
Alfic Haplorthods, sandy, and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 20 percent

Inclusions

Contrasting inclusions:
• The poorly drained Leafriver and Wakeley soils and the very poorly drained, euic Borosaprists; in depressions and drainageways
• Glossic Eutroboralfs in landscape positions similar to those of the major soils

Similar inclusions:
• Sandy soils that do not have a dark brown subsoil
• Sandy soils that do not have loamy textures in the profile

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Mapleleaf viburnum
Secondary plant association: Northern red oak-Red maple-Trefoil

235C—Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy, complex, rolling

Setting

Landform: Sandy end moraines and ground moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Alfic Haplorthods, sandy over loamy

Organic mat:
0 to 2 inches—black, partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark grayish brown sand

Subsurface layer:
4 to 6 inches—grayish brown sand

Subsoil:
6 to 9 inches—dark brown loamy sand
9 to 27 inches—strong brown sand
27 to 44 inches—brown sandy clay loam

Substratum:
44 to 52 inches—yellowish brown loamy sand
52 to 120 inches—brownish yellow sand

Alfic Haplorthods, sandy

Organic mat:
0 to 2 inches—partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark gray loamy sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 10 inches—dark brown loamy sand
10 to 17 inches—strong brown sand
17 to 37 inches—yellowish brown sand
37 to 42 inches—dark brown sandy loam

Substratum:
42 to 77 inches—reddish yellow sand
77 to 180 inches—brownish yellow sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate or severe

Composition

Alfic Haplorthods, sandy over loamy, and similar soils: 40 to 70 percent
Alfic Haplorthods, sandy, and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 20 percent

Inclusions

Contrasting inclusions:
• The poorly drained Leafriver and Wakeley soils and the very poorly drained, euic Borosaprists; in depressions and drainageways
• The somewhat poorly drained Alfic Haplaquods in depressions and drainageways
• Glossic Eutroboralfs in landscape positions similar to those of the major soils

Similar inclusions:
• Sandy soils that do not have a dark brown subsoil
• Sandy soils that do not have loamy textures in the profile

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Mapleleaf viburnum
Secondary plant association: Northern red oak-Red maple-Trefoil

235D—Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy, complex, hilly

Setting

Landform: Overwashed end moraines and ground moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Alfic Haplorthods, sandy over loamy

Organic mat:
0 to 2 inches—black, partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark grayish brown sand

Subsurface layer:
4 to 6 inches—grayish brown sand

Subsoil:
6 to 9 inches—dark brown loamy sand
9 to 27 inches—strong brown sand
27 to 44 inches—brown sandy clay loam

Substratum:
44 to 52 inches—yellowish brown loamy sand
52 to 120 inches—brownish yellow sand

Alfic Haplorthods, sandy

Organic mat:
0 to 2 inches—partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark gray loamy sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 10 inches—dark brown loamy sand
10 to 17 inches—strong brown sand
17 to 37 inches—yellowish brown sand
37 to 42 inches—dark brown sandy loam

Substratum:
42 to 77 inches—reddish yellow sand
77 to 180 inches—brownish yellow sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Depth to the water table: More than 15 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate or severe

Composition

Alfic Haplorthods, sandy over loamy, and similar soils: 40 to 70 percent
Alfic Haplorthods, sandy, and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 20 percent

Inclusions

Contrasting inclusions:
• The poorly drained Leafriver and Wakeley soils and the very poorly drained, euic Borosaprists; in depressions and drainageways
• The somewhat poorly drained Alfic Haplaquods in depressions and drainageways
• Glossic Eutroboralfs in landscape positions similar to those of the major soils

Similar inclusions:
• Sandy soils that do not have a dark brown subsoil
• Sandy soils that do not have loamy textures in the profile

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Management practices that disturb the soil should be limited in steep areas. Special care is needed in the placement of roads and trails.
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Mapleleaf viburnum
Secondary plant association: Northern red oak-Red maple-Trefoil

236B—Arenic Eutroboralfs, nearly level and undulating

Setting

Landform: Overwashed end moraines and ground moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—light brownish gray sand

Subsoil:
4 to 10 inches—dark yellowish brown sand
10 to 30 inches—yellowish brown loamy sand
30 to 35 inches—strong brown sandy loam

Substratum:
35 to 45 inches—dark brown sandy clay loam
45 to 70 inches—yellowish brown loamy sand
70 to 100 inches—light yellowish brown, stratified sands

Soil Properties and Qualities

Permeability: Moderate or moderately slow
Available water capacity: Low
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Slow
Flooding: None
Organic matter content: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Arenic Eutroboralfs and similar soils: 60 to 80 percent
Contrasting inclusions: 20 to 40 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Alfic Haplaquods and Allendale soils and the very poorly drained, euic Borosaprists; in depressions and drainageways

Similar inclusions:
• Soils that are moderately well drained
• Soils that have a loamy surface layer
• Soils that have a dark brown subsoil

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Mapleleaf viburnum
Secondary plant association: Northern red oak-Red maple-Trefoil

236C—Arenic Eutroboralfs, rolling

Setting

Landform: Overwashed end moraines and ground moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—light brownish gray sand

Subsoil:
4 to 10 inches—dark yellowish brown sand
10 to 30 inches—yellowish brown loamy sand
30 to 35 inches—strong brown sandy loam

Substratum:
35 to 45 inches—dark brown sandy clay loam
45 to 70 inches—yellowish brown loamy sand
70 to 100 inches—light yellowish brown, stratified sands

Soil Properties and Qualities

Permeability: Moderate or moderately slow
Available water capacity: Low
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe

Composition

Arenic Eutroboralfs and similar soils: 60 to 80 percent

Contrasting inclusions: 20 to 40 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Alfic Haplaquods and Allendale soils and the very poorly drained, euic Borosaprists; in depressions and drainageways

Similar inclusions:
• Soils that are moderately well drained
• Soils that have a loamy surface layer
• Soils that have a dark brown subsoil

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality
Management considerations:
• Because dry, loose sand can be easily displaced by heavy equipment, logging roads may need to be stabilized.
• Planting when the soil is moist can reduce the seedling mortality rate.
• The seedling mortality rate may be higher in areas that have southern exposures than in other areas.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Mapleleaf viburnum
Secondary plant association: Northern red oak-Red maple-Trefoil

237B—Glossic Eutroboralfs, nearly level and undulating

Setting

Landform: Ground moraines and end moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark gray sandy loam

Subsoil:
3 to 12 inches—brown and dark brown loamy sand
12 to 29 inches—reddish brown sandy clay loam and brown sandy loam
29 to 43 inches—brown loamy sand

Substratum:
43 to 58 inches—reddish brown loamy sand
58 to 84 inches—stratified reddish brown and yellowish brown loam

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate

Composition

Glossic Eutroboralfs and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
• The excessively drained, sandy Entic Haplorthods in landscape positions similar to those of the Glossic Eutroboralfs
• The somewhat poorly drained Allendale soils, the poorly drained Typic Haplaquods, and the very poorly drained, euic Borosaprists; in depressions and drainageways

Similar inclusions:
• Soils that are moderately well drained
• Soils that have a dark subsoil
• Soils that have a surface layer of loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Compaction
Management considerations:
• The use of heavy equipment may cause compaction in areas where the soils have a loamy surface layer. Using the equipment only during dry periods or during winter helps to prevent surface compaction.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Trefoil

Secondary plant association: Northern red oak-Red maple-Mapleleaf viburnum

237C—Glossic Eutroboralfs, rolling

Setting

Landform: Ground moraines and end moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark gray sandy loam

Subsoil:
3 to 12 inches—brown and dark brown loamy sand
12 to 29 inches—reddish brown sandy clay loam and brown sandy loam
29 to 43 inches—brown loamy sand

Substratum:
43 to 58 inches—reddish brown loamy sand
58 to 84 inches—stratified reddish brown and yellowish brown loam

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate

Composition

Glossic Eutroboralfs and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
• The excessively drained, sandy Entic Haplorthods in landscape positions similar to those of the Glossic Eutroboralfs
• The somewhat poorly drained Allendale soils, the poorly drained Typic Haplaquods, and the very poorly drained, euic Borosaprists; in depressions and drainageways

Similar inclusions:
• Soils that are moderately well drained
• Soils that have a dark subsoil
• Soils that have a surface layer of loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Compaction
Management considerations:
• The use of heavy equipment may cause compaction in areas where the soils have a loamy surface layer. Using the equipment only during dry periods or during winter helps to prevent surface compaction.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Trefoil
Secondary plant association: Northern red oak-Red maple-Mapleleaf viburnum

237D—Glossic Eutroboralfs, hilly

Setting

Landform: Ground moraines and end moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark gray sandy loam

Subsoil:
3 to 12 inches—brown and dark brown loamy sand
12 to 29 inches—reddish brown sandy clay loam and brown sandy loam
29 to 43 inches—brown loamy sand

Substratum:
43 to 58 inches—reddish brown loamy sand
58 to 84 inches—stratified reddish brown and yellowish brown loam

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Rapid
Flooding: None

Organic matter content: Moderate
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate

Composition

Glossic Eutroboralfs and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
• The excessively drained, sandy Entic Haplorthods in landscape positions similar to those of the Glossic Eutroboralfs
• The somewhat poorly drained Allendale soils, the poorly drained Typic Haplaquods, and the very poorly drained, euic Borosaprists; in depressions and drainageways

Similar inclusions:
• Soils that are moderately well drained
• Soils that have a dark subsoil
• Soils that have a surface layer of loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Compaction and erosion hazard
Management considerations:
• The use of heavy equipment may cause compaction in areas where the soils have a loamy surface layer. Using the equipment only during dry periods or during winter helps to prevent surface compaction.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Trefoil
Secondary plant association: Northern red oak-Red maple-Mapleleaf viburnum

247B—Glennie-Bamfield complex, nearly level and undulating

Setting

Landform: End moraines and ground moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Reference Profile

Glennie

Organic mat:
0 to 2 inches—black, partially decomposed forest litter

Surface layer:
2 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown loamy sand

Subsoil:
7 to 11 inches—dark brown sandy loam
11 to 20 inches—strong brown loamy sand
20 to 40 inches—brown loamy sand and reddish brown loam
40 to 46 inches—reddish brown, mottled sandy clay loam and brown, mottled sandy loam
46 to 56 inches—dark reddish brown, mottled clay
56 to 85 inches—reddish brown sandy clay loam

Substratum:
85 to 99 inches—reddish brown sandy clay loam

Bamfield

Organic mat:
0 to 1 inch—partially decomposed leaf litter

Surface layer:
1 to 6 inches—very dark grayish brown fine sandy loam

Subsoil:
6 to 11 inches—yellowish brown fine sandy loam
11 to 18 inches—pinkish gray fine sandy loam
18 to 21 inches—reddish brown clay loam and pinkish gray fine sandy loam
21 to 31 inches—reddish brown, mottled clay loam

Substratum:
31 to 60 inches—light reddish brown clay loam

Soil Properties and Qualities

Permeability: Glennie—moderately rapid in the upper

part, very slow in the lower part; Bamfield—very slow
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Glennie—perched at a depth of 3.5 to 4.5 feet from November through May; Bamfield—perched at a depth of 1.5 to 3.0 feet from November through May
Surface runoff: Very slow to medium
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate

Composition

Glennie and similar soils: 35 to 50 percent
Bamfield and similar soils: 35 to 50 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Alfic Haplaquods and Allendale soils and the very poorly drained, euic Borosaprists; in depressions and drainageways
• The excessively drained, sandy Entic Haplorthods in landscape positions similar to those of the major soils

Similar inclusions:
• Sandy soils that are moderately well drained
• Soils that have a surface layer of fine sand

Use and Management

Land use: Woodland

Major management concerns: Compaction
Management considerations:
• The use of heavy equipment may cause compaction in areas where the soils have a loamy surface layer. Using the equipment only during dry periods or during winter helps to prevent surface compaction.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: Glennie—5D; Bamfield—3L
Michigan soil management group: Glennie—4/2a-f; Bamfield—3/2a
Primary plant association: Sugar maple-White ash-Sweet cicely
Secondary plant association: Northern red oak-Red maple-Trefoil

247C—Glennie-Bamfield complex, rolling

Setting

Landform: End moraines and ground moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Reference Profile

Glennie

Organic mat:
0 to 2 inches—black, partially decomposed forest litter

Surface layer:
2 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown loamy sand

Subsoil:
7 to 11 inches—dark brown sandy loam
11 to 20 inches—strong brown loamy sand
20 to 40 inches—brown loamy sand and reddish brown loam
40 to 46 inches—reddish brown sandy clay loam and brown sandy loam
46 to 56 inches—dark reddish brown clay
56 to 85 inches—reddish brown sandy clay loam

Substratum:
85 to 99 inches—reddish brown sandy clay loam

Bamfield

Organic mat:
0 to 1 inch—partially decomposed leaf litter

Surface layer:
1 to 6 inches—very dark grayish brown fine sandy loam

Subsoil:
6 to 11 inches—yellowish brown fine sandy loam
11 to 18 inches—pinkish gray fine sandy loam
18 to 21 inches—reddish brown clay loam and pinkish gray fine sandy loam
21 to 31 inches—reddish brown clay loam

Substratum:
31 to 60 inches—light reddish brown clay loam

Soil Properties and Qualities

Permeability: Glennie—moderately rapid in the upper part, very slow in the lower part; Bamfield—very slow
Available water capacity: Moderate

Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Medium or rapid
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate

Composition

Glennie and similar soils: 35 to 60 percent
Bamfield and similar soils: 35 to 50 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained, sandy Alfic Haplaquods, the somewhat poorly drained Allendale soils, and the very poorly drained, euic Borosaprists; in depressions and drainageways
• The excessively drained, sandy Entic Haplorthods in landscape positions similar to those of the major soils

Similar inclusions:
• Sandy soils that are moderately well drained
• Soils that have a surface layer of fine sand

Use and Management

Land use: Woodland

Major management concerns: Compaction, equipment limitation
Management considerations:
• The use of heavy equipment may cause compaction in areas where the soils have a loamy surface layer. Using the equipment only during dry periods or during winter helps to prevent surface compaction.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Glennie—5D; Bamfield—3L
Michigan soil management group: Glennie—4/2a-f; Bamfield—3/2a
Primary plant association: Sugar maple-White ash-Sweet cicely
Secondary plant association: Northern red oak-Red maple-Trefoil

247D—Glennie-Bamfield complex, hilly

Setting

Landform: End moraines and ground moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 20 to 100 acres

Reference Profile

Glennie

Organic mat:
0 to 2 inches—black, partially decomposed forest litter

Surface layer:
2 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown loamy sand

Subsoil:
7 to 11 inches—dark brown sandy loam
11 to 20 inches—strong brown loamy sand
20 to 40 inches—brown loamy sand and reddish brown loam
40 to 46 inches—reddish brown sandy clay loam and brown sandy loam
46 to 56 inches—dark reddish brown clay
56 to 85 inches—reddish brown sandy clay loam

Substratum:
85 to 99 inches—dark reddish brown sandy clay loam

Bamfield

Organic mat:
0 to 1 inch—partially decomposed leaf litter

Surface layer:
1 to 6 inches—very dark grayish brown fine sandy loam

Subsoil:
6 to 11 inches—yellowish brown fine sandy loam
11 to 18 inches—pinkish gray fine sandy loam
18 to 21 inches—reddish brown clay loam and pinkish gray fine sandy loam
21 to 31 inches—reddish brown clay loam

Substratum:
31 to 60 inches—light reddish brown clay loam

Soil Properties and Qualities

Permeability: Glennie—moderately rapid in the upper part, very slow in the lower part; Bamfield—very slow

Available water capacity: Moderate
Drainage class: Well drained
Depth to the water table: More than 6 feet
Surface runoff: Rapid
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate

Composition

Glennie and similar soils: 35 to 60 percent
Bamfield and similar soils: 35 to 50 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Alfic Haplaquods and Allendale soils and the very poorly drained, euic Borosaprists; in depressions and drainageways
• The excessively drained, sandy Entic Haplorthods in landscape positions similar to those of the major soils

Similar inclusions:
• Sandy soils that are moderately well drained
• Soils that have a surface layer of fine sand

Use and Management

Land use: Woodland

Major management concerns: Compaction, equipment limitation, erosion hazard
Management considerations:
• The use of heavy equipment may cause compaction in areas of soils that have a fine textured surface layer. Using the equipment only during dry periods or during winter helps to prevent surface compaction.
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
• The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: Glennie—5R; Bamfield—3R
Michigan soil management group: Glennie—4/2a-f; Bamfield—3/2a
Primary plant association: Sugar maple-White ash-Sweet cicely
Secondary plant association: Northern red oak-Red maple-Trefoil

250D—Glossic Eutroboralfs-Borosaprists, euic, complex, nearly level to hilly

Setting

Landform: Pitted moraines
Slope: 0 to 30 percent
Shape of areas: Irregular
Size of areas: 40 to 300 acres

Reference Profile

Glossic Eutroboralfs

Surface layer:
0 to 3 inches—very dark gray sandy loam

Subsoil:
3 to 12 inches—brown and dark brown loamy sand
12 to 29 inches—reddish brown sandy clay loam and brown sandy loam
29 to 43 inches—brown loamy sand

Substratum:
43 to 58 inches—reddish brown loamy sand
58 to 84 inches—stratified reddish brown and yellowish brown loam

Borosaprists

Surface layer:
0 to 9 inches—black muck

Subsoil:
9 to 15 inches—dark reddish brown muck
15 to 20 inches—black muck
20 to 60 inches—gray sand and loamy sand

Soil Properties and Qualities

Permeability: Glossic Eutroboralfs—moderate; Borosaprists—slow
Available water capacity: Glossic Eutroboralfs—moderate; Borosaprists—high
Drainage class: Glossic Eutroboralfs—well drained; Borosaprists—very poorly drained
Seasonal high water table: Glossic Eutroboralfs—at a depth of more than 6 feet; Borosaprists—1 foot above to 1 foot below the surface from October through May
Surface runoff: Glossic Eutroboralfs—rapid; Borosaprists—very slow or ponded
Flooding: None
Organic matter content: Glossic Eutroboralfs—moderate; Borosaprists—high

Hazard of water erosion: Slight
Hazard of soil blowing: Glossic Eutroboralfs—moderate; Borosaprists—slight

Composition

Glossic Eutroboralfs and similar soils: 60 to 70 percent
Borosaprists and similar soils: 20 to 40 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
• The very poorly drained, dysic Borosaprists in depressions
• The excessively drained, sandy Entic Haplorthods on uplands

Similar inclusions:
• Sandy soils that have a fine textured substratum
• Soils that have a surface layer of sand or loamy sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation
Management considerations:
• Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment in areas of the Glossic Eutroboralfs. Logging roads should be designed so that they conform to the topography.
• Because of wetness and low strength in areas of the Borosaprists, harvesting is not recommended.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: None assigned
Secondary plant association: None assigned

252A—Borosaprists, euic-Au Gres complex, nearly level

Setting

Landform: Lake terraces
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 60 to 300 acres

Reference Profile

Borosaprists

Surface layer:
0 to 9 inches—black muck

Subsoil:
9 to 15 inches—dark reddish brown muck
15 to 20 inches—black muck
20 to 60 inches—gray sand and loamy sand

Au Gres

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 10 inches—pinkish gray sand

Subsoil:
10 to 14 inches—dark brown, mottled sand
14 to 27 inches—dark yellowish brown, mottled sand
27 to 33 inches—yellowish brown, mottled sand

Substratum:
33 to 60 inches—pale brown, mottled sand

Soil Properties and Qualities

Permeability: Borosaprists—slow; Au Gres—rapid
Available water capacity: Borosaprists—high; Au Gres—low
Drainage class: Borosaprists—very poorly drained; Au Gres—somewhat poorly drained
Seasonal high water table: Borosaprists—1 foot above to 1 foot below the surface from October through May; Au Gres—at a depth of 0.5 foot to 1.5 feet from October through May
Surface runoff: Borosaprists—very slow or ponded; Au Gres—very slow
Flooding: None
Organic matter content: Borosaprists—high; Au Gres—moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Borosaprists—slight; Au Gres—severe

Composition

Borosaprists and similar soils: 35 to 60 percent
Au Gres and similar soils: 35 to 55 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• The excessively drained, sandy Entic Haplorthods on uplands

Similar inclusions:
• Sandy soils that have a fine textured substratum
• Organic soils that are acid

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, windthrow
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
• Windthrow can be minimized by employing harvest methods that do not leave the remaining trees widely spaced.
• Because of wetness and low strength, harvesting is not recommended.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: Borosaprists—none assigned; Au Gres—6W
Michigan soil management group: Borosaprists—none assigned; Au Gres—5b
Primary plant association: Northern red oak-Red maple-Leatherleaf-Blueberry
Secondary plant association: Red maple-Balsam fir-Bunchberry

253A—Au Gres-Allendale-Croswell sands, nearly level

Setting

Landform: Outwash plains and lake plains
Slope: 0 to 4 percent
Shape of areas: Irregular
Size of areas: 40 to 400 acres

Reference Profile

Au Gres

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 10 inches—pinkish gray sand

Subsoil:
10 to 14 inches—dark brown, mottled sand
14 to 27 inches—dark yellowish brown, mottled sand
27 to 33 inches—yellowish brown, mottled sand

Substratum:
33 to 60 inches—pale brown, mottled sand

Allendale

Surface layer:
0 to 11 inches—very dark grayish brown sand

Subsurface layer:
11 to 13 inches—pale brown, mottled sand

Subsoil:
13 to 20 inches—dark brown, mottled sand
20 to 22 inches—yellowish brown, mottled sand
22 to 25 inches—reddish brown, mottled sandy loam
25 to 60 inches—reddish brown, mottled silty clay

Croswell

Organic mat:
0 to 1 inch—black, well decomposed forest leaf litter

Surface layer:
1 to 4 inches—dark grayish brown sand

Subsoil:
4 to 10 inches—dark brown sand
10 to 20 inches—strong brown sand
20 to 29 inches—brownish yellow, mottled sand

Substratum:
29 to 80 inches—yellowish brown and light yellowish brown, mottled sand

Soil Properties and Qualities

Permeability: Au Gres—rapid; Allendale—rapid in the upper part, very slow in the lower part; Croswell—rapid
Available water capacity: Au Gres—low; Allendale—moderate; Croswell—low
Drainage class: Au Gres and Allendale—somewhat poorly drained; Croswell—moderately well drained
Seasonal high water table: Au Gres—at a depth of 0.5 foot to 1.5 feet (clay likely below the depth of observation) from October through May; Allendale—perched at a depth of 0.5 foot to 1.5 feet from October through May; Croswell—at a depth of 2.0 to 3.5 feet (clay likely below the depth of observation) from October through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Au Gres and Allendale—moderate; Croswell—low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Au Gres and similar soils: 30 to 50 percent
Allendale and similar soils: 15 to 40 percent

Croswell and similar soils: 15 to 40 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
- The excessively drained, sandy Entic Haplorthods on uplands
- The very poorly drained, dysic Borosaprists in depressions

Similar inclusions:
- Moderately well drained soils that have a fine textured substratum
- Soils that have a finer textured surface layer

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow
Management considerations:
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Skidders should not be used during wet periods.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by employing harvest methods that do not leave the remaining trees widely spaced.

Interpretive Groups

Land capability classification: IVw
Woodland ordination symbol: Au Gres—6W; Allendale—4W; Croswell—5S
Michigan soil management group: Au Gres—5b; Allendale—4/1b; Croswell—5a
Primary plant association: None assigned
Secondary plant association: None assigned

262A—Au Gres sand, nearly level

Setting

Landform: Outwash plains and sandy lake plains
Slope: 0 to 4 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Reference Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 10 inches—pinkish gray sand

Subsoil:
10 to 14 inches—dark brown, mottled sand
14 to 27 inches—dark yellowish brown, mottled sand
27 to 33 inches—yellowish brown, mottled sand

Substratum:
33 to 60 inches—pale brown, mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat poorly drained
Depth to the water table: 0.5 foot to 1.5 feet from October through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Au Gres and similar soils: 70 to 80 percent
Contrasting inclusions: 20 to 30 percent

Inclusions

Contrasting inclusions:
- The excessively drained, sandy Entic Haplorthods on knolls
- The very poorly drained, dysic Borosaprists in depressions

Similar inclusions:
- Sandy soils that have a fine textured substratum
- Soils that have organic accumulation at the surface
- Soils that have a cemented subsoil

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow
Management considerations:
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Skidders should not be used during wet periods.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by employing harvest methods that do not leave the remaining trees widely spaced.

Interpretive Groups

Land capability classification: IVw
Woodland ordination symbol: 6W

Michigan soil management group: 5b
Primary plant association: Northern red oak-Red maple-Leatherleaf-Blueberry
Secondary plant association: Red maple-Balsam fir-Bunchberry

263A—Alfic Haplaquods, nearly level

Setting

Landform: Outwash plains and sandy lake plains
Slope: 0 to 4 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsurface layer:
3 to 8 inches—light brownish gray sand

Subsoil:
8 to 20 inches—strong brown sand
20 to 35 inches—strong brown loamy sand

Substratum:
35 to 70 inches—yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Moderate
Drainage class: Somewhat poorly drained
Depth to the water table: 0.5 foot to 1.5 feet from October through May
Surface runoff: Very slow
Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Severe

Composition

Alfic Haplaquods and similar soils: 70 to 80 percent
Contrasting inclusions: 20 to 30 percent

Inclusions

Contrasting inclusions:
• The excessively drained, sandy Entic Haplorthods on knolls
• The very poorly drained, dysic Borosaprists in depressions

Similar inclusions:
• Sandy soils that have a fine textured substratum
• Soils that have organic accumulation at the surface
• Soils that have a cemented subsoil

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
• Skidders should not be used during wet periods.
• Trees that can withstand seasonal wetness should be selected for planting.
• Windthrow can be minimized by employing harvest methods that do not leave the remaining trees widely spaced.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Red maple-Balsam fir-Bunchberry
Secondary plant association: Northern red oak-Red maple-Leatherleaf-Blueberry

264A—Allendale loamy sand, nearly level

Setting

Landform: Outwash plains and sandy lake plains
Slope: 0 to 4 percent
Shape of areas: Irregular
Size of areas: 20 to 100 acres

Reference Profile

Surface layer:
0 to 11 inches—very dark grayish brown loamy sand

Subsurface layer:
11 to 13 inches—pale brown, mottled sand

Subsoil:
13 to 20 inches—dark brown, mottled sand
20 to 22 inches—yellowish brown, mottled sand
22 to 25 inches—reddish brown, mottled sandy loam
25 to 60 inches—reddish brown, mottled silty clay

Soil Properties and Qualities

Permeability: Rapid in the upper part; very slow in the lower part
Available water capacity: Moderate
Drainage class: Somewhat poorly drained
Seasonal high water table: Perched at a depth of 0.5 foot to 1.5 feet from October through May
Surface runoff: Very slow

Flooding: None
Organic matter content: Moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate

Composition

Allendale and similar soils: 70 to 80 percent
Contrasting inclusions: 20 to 30 percent

Inclusions

Contrasting inclusions:
- The excessively drained, sandy Entic Haplorthods on knolls
- The very poorly drained, dysic Borosaprists in depressions

Similar inclusions:
- Sandy soils that do not have a fine textured substratum
- Soils that have organic accumulation at the surface

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow
Management considerations:
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Skidders should not be used during wet periods.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by employing harvest methods that do not leave the remaining trees widely spaced.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: 4W
Michigan soil management group: 4/1b
Primary plant association: Mixed ash-Basswood-Downy yellow violet
Secondary plant association: Red maple-Balsam fir-Bunchberry

272—Haplaquods-Fluvaquents complex

Setting

Landform: Outwash plains, deltas, and flood plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Haplaquods

Surface layer:
0 to 3 inches—very dark gray sand

Subsurface layer:
3 to 8 inches—light brownish gray, mottled sand

Subsoil:
8 to 20 inches—strong brown, mottled sand
20 to 35 inches—strong brown, mottled loamy sand

Substratum:
35 to 70 inches—yellowish brown sand

Fluvaquents

Surface layer:
0 to 3 inches—black muck
3 to 8 inches—very dark gray, mottled loamy sand

Subsurface layer:
8 to 15 inches—brown, mottled loamy sand
15 to 38 inches—yellowish brown, mottled sand

Subsoil:
38 to 60 inches—pale brown, mottled sand that has thin layers of silt, silty clay, and clay

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Haplaquods—low; Fluvaquents—moderate
Drainage class: Poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Very slow
Flooding: Haplaquods—none; Fluvaquents—frequent
Organic matter content: Moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Slight

Composition

Haplaquods and similar soils: 40 to 60 percent
Fluvaquents and similar soils: 30 to 50 percent
Contrasting inclusions: 20 to 30 percent

Inclusions

Contrasting inclusions:
- The excessively drained, sandy Entic Haplorthods on knolls
- The very poorly drained, dysic and euic Borosaprists in depressions

Similar inclusions:
- Sandy soils that have a fine textured substratum

• Soils that have more organic accumulation at the surface
• Soils that have a finer textured surface layer
• Soils that have a cemented subsoil

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, windthrow
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
• Skidders should not be used during wet periods.
• Windthrow can be minimized by employing harvest methods that do not leave the remaining trees widely spaced.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern red oak-Red maple-Leatherleaf-Blueberry
Secondary plant association: Red maple-Balsam fir-Bunchberry

273—Leafriver-Wakeley complex

Setting

Landform: Outwash plains and lake plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Leafriver

Surface layer:
0 to 9 inches—black muck

Subsoil:
9 to 21 inches—brown, mottled sand

Substratum:
21 to 27 inches—grayish brown, mottled sand
27 to 60 inches—dark grayish brown sand

Wakeley

Surface layer:
0 to 6 inches—black, mottled mucky sand

Substratum:
6 to 12 inches—gray sand
12 to 24 inches—grayish brown, mottled sand
24 to 29 inches—grayish brown, mottled, stratified sand and loamy sand
29 to 34 inches—pinkish gray, mottled clay
34 to 60 inches—pinkish gray, mottled, stratified clay and silty clay

Soil Properties and Qualities

Permeability: Leafriver—rapid; Wakeley—rapid in the upper part, very slow in the lower part
Available water capacity: Moderate
Drainage class: Very poorly drained
Seasonal high water table: Leafriver—1 foot above to 1 foot below the surface (clay likely below the depth of observation) from October through May; Wakeley—perched 1 foot above to 1 foot below the surface from October through May
Surface runoff: Very slow or ponded
Flooding: None
Organic matter content: Leafriver—high; Wakeley—moderate
Hazard of water erosion: Slight
Hazard of soil blowing: Slight

Composition

Leafriver and similar soils: 35 to 60 percent
Wakeley and similar soils: 40 to 55 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
• The moderately well drained, sandy Entic Haplorthods on knolls
• The very poorly drained, dysic Borosaprists in depressions

Similar inclusions:
• Sandy soils that have a fine textured surface layer
• Soils that have deep organic accumulation

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, windthrow
Management considerations:
• The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
• Skidders should not be used during wet periods.
• Windthrow can be minimized by employing harvest methods that do not leave the remaining trees widely spaced.
• Because of the wetness and low strength, harvesting is not recommended in areas of organic soils.

Interpretive Groups

Land capability classification: VIw
Woodland ordination symbol: Leafriver—2W; Wakeley—3W
Michigan soil management group: Leafriver—5c; Wakeley—4/1c
Primary plant association: Red maple-Balsam fir-Bunchberry
Secondary plant association: Northern red oak-Red maple-Leatherleaf-Blueberry

274—Typic Haplaquods

Setting

Landform: Outwash plains and lake plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Reference Profile

Surface layer:
0 to 3 inches—black muck

Subsurface layer:
3 to 8 inches—pinkish gray, mottled fine sand

Subsoil:
8 to 14 inches—dark reddish brown, mottled fine sand
14 to 22 inches—dark brown fine sand
22 to 26 inches—dark yellowish brown, mottled fine sand
26 to 30 inches—yellowish brown, mottled fine sand

Substratum:
30 to 60 inches—light brownish gray fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Very slow or ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: None
Hazard of soil blowing: None

Composition

Typic Haplaquods and similar soils: 75 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained, sandy Entic Haplorthods on knolls
- The very poorly drained, dysic Borosaprists in depressions

Similar inclusions:
- Poorly drained soils that have sandy textures

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, windthrow
Management considerations:
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Skidders should not be used during wet periods.
- Harvesting is not recommended.
- Windthrow can be minimized by employing harvest methods that do not leave the remaining trees widely spaced.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Mixed ash-Basswood-Downy yellow violet
Secondary plant association: Northern whitecedar-Eastern hemlock-Canada violet

280—Aquents and Histosols, ponded

Setting

Landform: Outwash plains and flood plains
Slope: Nearly level
Shape of areas: Oval
Size of areas: 5 to 100 acres

Reference Profile

Aquents

0 to 60 inches—variable

Histosols

0 to 60 inches—black muck

Soil Properties and Qualities

Permeability: Variable

Available water capacity: Variable
Drainage class: Very poorly drained
Seasonal high water table: At the surface to 1 foot above the surface year-round
Surface runoff: Ponded
Flooding: Frequent
Organic matter content: High
Hazard of water erosion: None
Hazard of soil blowing: None

Composition

Aquents: 50 to 70 percent
Histosols: 30 to 40 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
• Small areas of somewhat poorly drained soils at the edges of the unit
• Small areas of open water

Use and Management

Land use: Wetland wildlife habitat

Major management concerns: Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: None assigned
Secondary plant association: None assigned

281—Borosaprists, dysic

Setting

Landform: Shallow closed depressions on outwash plains, lake plains, and flood plains
Slope: Nearly level
Shape of areas: Oval
Size of areas: 5 to 200 acres

Reference Profile

Surface layer:
0 to 12 inches—black muck

Subsoil:
12 to 33 inches—black muck

Substratum:
33 to 60 inches—gray sand

Soil Properties and Qualities

Permeability: Moderately slow to moderately rapid in the upper part, rapid in the lower part
Available water capacity: High
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Very slow or ponded
Flooding: None
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Slight

Composition

Borosaprists: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Au Gres soils on low knolls and ridges

Similar inclusions:
• Soils that have organic material less than 16 inches thick or more than 50 inches thick

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation
Management considerations:
• Because of wetness and low strength, woodland management is not recommended.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Black spruce-Tamarack-Labrador tea
Secondary plant association: None assigned

282—Borosaprists, euic

Setting

Landform: Depressions on end moraines, till plains, ground moraines, and alluvial plains
Slope: None
Shape of areas: Oval and irregular
Size of areas: 20 to 200 acres

Reference Profile

Surface layer:
0 to 9 inches—black muck

Subsoil:
9 to 38 inches—dark reddish brown muck
38 to 60 inches—black muck

Soil Properties and Qualities

Permeability: Moderately slow to moderately rapid
Available water capacity: High
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from October through May
Surface runoff: Very slow or ponded
Flooding: Occasional
Organic matter content: High
Hazard of water erosion: Slight
Hazard of soil blowing: Slight

Composition

Borosaprists: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
• Dysic Borosaprists in landscape positions similar to those of the major soils
• The somewhat poorly drained Au Gres soils on low knolls and ridges

Similar inclusions:
• Soils that have sandy material below a depth of 16 inches
• Soils that have loamy or clayey material below a depth of 16 inches
• Soils that have a higher fiber content in the subsoil

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation
Management considerations:
• Because of wetness and low strength, woodland management is not recommended.

Interpretive Groups

Land capability classification: None assigned
Woodland ordination symbol: None assigned
Michigan soil management group: None assigned
Primary plant association: Northern whitecedar-Eastern hemlock-Canada violet
Secondary plant association: Mixed ash-Basswood-Downy yellow violet

Prime Farmland

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

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

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

About 68,500 acres in the survey area, or about 16 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the southern part, mainly in associations 3, 4, 5, and 6, which are described under the heading "General Soil Map Units."

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

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

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

Use and Management of the Soils

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

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

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

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

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

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups. These groups are listed at the end of each map unit description and in the "Interpretive Groups" section.

Crops and Pasture

This section was prepared by George Byelich, Alcona County Cooperative Extension Service.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils are identified, the estimated yields of the main crops and hay and pasture plants are listed for each soil, and the system of land capability classification used by the Natural Resources Conservation Service is explained.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

In 1992, 29,000 acres in Alcona County was used as cropland or for pasture and hay (Michigan Department of Agriculture, 1992). In addition, 305,000 acres was used as woodland, both publicly owned and privately owned.

The potential for increased crop production is fair. Production can be increased by applying the latest technology on all of the cropland in the county. If fertility is enhanced, the production of alfalfa has the most potential for improvement.

Soil wetness is the major problem on much of the better cropland in Alcona County. In some areas the somewhat poorly drained Algonquin soils have been drained for use as cropland. Most of the poorly drained and very poorly drained soils cannot be economically drained. Such soils are in low-lying areas on plains and in depressions where ponding is frequent and suitable drainage outlets are not readily available. These soils are also subject to low soil temperatures, which hinder seed germination, and extended periods of frost. In areas of somewhat poorly drained soils, such as Richter, Kawkawlin, and

Killmaster soils, artificial drainage is needed. Unless the excess water is removed from these soils, tillage, seed germination, and growth are adversely affected.

Subsurface tile drainage systems generally are used to remove excess water. The proper spacing of tile drains compensates for differences in permeability of the soils. In some areas, open ditches are needed as outlets for the drains. More deep open ditches are needed to provide outlets for surface and subsurface drainage. Hoist and Negwegon soils are well drained and moderately well drained. Zimmerman, Mancelona, and Klacking soils are also well drained, but droughtiness during long dry periods is a problem. Small areas of wet soils along drainageways and swales commonly are used in combination with larger areas of well drained soils. Artificial drainage may be needed in some of the wet areas to prevent delays in fieldwork.

Care must be exercised to prevent the drainage of designated wetlands. Drainage of these areas could violate existing wetland laws and regulations and may jeopardize receipt of USDA benefits. Information about the design of drainage systems for each kind of soil is available in local offices of the Natural Resources Conservation Service.

Water erosion is a major hazard on some of the soils used for crops and pasture in Alcona County. Erosion reduces the productive capacity of the soil by removing the surface layer, which contains most of the available plant nutrients and organic matter. For example, the surface layer of the eroded Negwegon soils has a higher clay content and a lower organic matter content than the original surface layer. Because of the clay content, the plow layer stays wet longer after a rain and fieldwork can be delayed. The surface layer also tends to be cloddy and makes a poor seedbed. Surface crusting is common, and plant emergence can be difficult. More energy is required to till eroded soils than noneroded soils. Erosion on farmland also can result in the pollution of lakes and streams by sediment, nutrients, and pesticides.

Erosion-control practices provide a protective surface cover, reduce the runoff rate, and increase the rate of water infiltration. Conservation tillage, which leaves crop residue on the surface, increases the rate of water infiltration and helps to control runoff and erosion. No-till cropping of corn also reduces the hazard of erosion. No-till farming requires high levels of management and relies on herbicides and insecticides for weed and pest control. No-till is especially effective in minimizing erosion on the less clayey, sloping soils in the county. Contour farming or contour stripcropping can control erosion on long slopes, but these practices generally cannot be readily applied on the short, steep slopes that are common in Alcona County.

Grassed waterways are used on undulating and nearly level soils and are used on sloping soils to minimize gully erosion. They can be used to stabilize previously eroded areas that have been reshaped and seeded. Grassed waterways are installed on nearly level soils if a large watershed drains across the land. Subsurface drains generally are installed below the waterway to remove excess water. Drainage benefits vegetative growth and results in drier soil conditions, which facilitate the use of machinery.

Grade-stabilization structures help to control erosion where surface water drains into channels. These structures generally are used in conjunction with grassed waterways both at the outlet end and the inlet end. Grade-stabilization structures conduct the water to a lower elevation and at the same time prevent erosion at the sides and bottom of a channel.

Soil blowing is a hazard in Alcona County on soils that have a surface layer of sand, loamy sand, or sandy loam. Using surface mulch to maintain the plant cover, planting small grain buffer strips, leaving crop residue on the surface, and maintaining a rough surface through tillage help to control soil blowing on these soils. Vegetative barriers also are effective in reducing the hazard of soil blowing. Field windbreaks of adapted trees and shrubs planted at right angles to the prevailing wind provide long-term protection from erosion.

Soil fertility is naturally low in the sandy soils in the county. It is medium in most of the loamy soils. The soils that formed on till plains or moraines, such as Hoist and Killmaster soils, are moderately high in natural fertility. Soil fertility is quite variable because of differences in past land use and management. Most of the soils in the county are medium acid to neutral in the surface layer. Additions of lime, bio ash, and fertilizer to the soil 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 to determine the kind and amount of all nutrients to be applied (Michigan State University, 1992).

Soil tilth is an important factor in the germination of seeds and in the workability of the soil. Soils that have good tilth require a minimum of working for seed germination and plant growth. Many of the agricultural soils that are used for crops in Alcona County have a surface layer of clay loam, loam, or sandy loam. Soils that have good tilth have granular structure and contain a moderate to high amount of organic matter. Using machinery when the soils are wet results in soil compaction and surface crusting. Soil compaction and surface crusting reduce the rate of water infiltration and increase the runoff rate. Soil compaction and the loss of granular soil structure cause small individual soil particles to form. These small particles are carried away by wind and water. Preparing a good seedbed on severely eroded soils is difficult, mainly because of their susceptibility to excessive erosion. Using adequate surface and subsurface drainage, carefully timing fieldwork, and maintaining the content of organic matter through forage production improve soil structure and tilth and minimize soil compaction and erosion.

Oats, barley, and wheat are the main field crops suited to the climate and soils in Alcona County. Alfalfa is a commonly grown legume. Grasses grown for hay and pasture are mainly bromegrass, orchardgrass, and timothy. The county has a number of Christmas tree plantations.

Specialty crops, such as strawberries and raspberries, are grown only on a limited acreage in the county. The well drained loamy sands, sandy loams, and loams are suited to these crops. The latest information about growing specialty crops can be obtained at local offices of the Cooperative Extension Service.

Much of the permanent pasture in the county is in areas where erosion can be a hazard. Other areas of pasture are on wet soils. Control of erosion is particularly important during seeding operations. The need for lime and fertilizer should be determined by soil tests, and adequate amounts should be applied as required.

Grazing when the soils are wet can cause surface compaction, which hinders the growth of pasture plants. Proper harvesting methods, such as those used for hay or silage, increase plant growth and minimize soil compaction.

The productivity of a pasture and its ability to protect the soil surface are influenced by the number of livestock the pasture supports, the length of time the livestock graze, and the rainfall distribution. Good pasture management includes maintaining key forage plants by applying proper stocking rates, applying a system of pasture rotation, deferring grazing, grazing at the proper season, applying fertilizer as appropriate, and supplying water at strategic locations for livestock.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (USDA, 1961). Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units" and in the yields table.

At the end of each map unit description, the Michigan soil management group is listed. The soils in each map unit are assigned to a group according to the dominant texture, the drainage class, and the major management concerns (Mokma and others, 1982). More detailed information about these groups is available from the local office of the Michigan State University Cooperative Extension Service.

Woodland Management and Productivity

Originally, a dense forest covered all of the survey area, except for a few bogs and marshes. Most of the area was logged, and the slash was burned. Many areas were cleared. Many of the cleared areas have either reverted to natural forest or have been planted to pines.

Currently, Alcona County has about 305,000 acres of woodland. This acreage represents about 70 percent of the total land area. Approximately 110,000 acres is in the Huron National Forest. Private forest tracts and hunting clubs have holdings of more than 180,000 acres.

There are five major kinds of natural forest cover within the county (Society of American Foresters, 1954). Each kind is distinctly different from the others. Each has different value and potential for forest use and for producing woodland products. The soils in the areas of the different kinds of forest cover generally are quite different.

The Jack Pine forest cover type makes up about 29,000 acres. Jack pine and northern pin oak are the dominant species. Other common associated trees include eastern white pine, red pine, and aspen. This cover type is mainly in areas of the Grayling and Graycalm soils. These are deep, sandy soils that have weak profile development. The more droughty and less fertile soils support only northern pin oak and jack pine. Growth is slow, and reestablishing tree cover in cutover areas is difficult.

The Oak forest cover type makes up about 60,000 acres. Northern red oak is the dominant species. Other common associated trees include bigtooth aspen, red pine, eastern white pine, and paper birch. This cover type is mainly in areas of the McGinn and Glennie soils. These are deep, sandy and loamy soils. Growth is good on these soils. Plantations of red pine and eastern white pine are common in areas of this cover type.

The Northern Hardwoods forest cover type makes up about 14,000 acres. Sugar maple is the most common species, but American beech and red maple are also common. Other common associated trees include black cherry, northern red oak, aspen, American basswood, eastern hemlock, eastern white pine, red pine, and white ash. This cover type is mainly in areas of the Nester, Alcona, Negwegon, Hoist, and Bamfield soils. These are well drained and moderately well drained, loamy and clayey soils. The soils of this cover type are the most productive in the survey area. Growth is good or excellent, and the potential for wood products is high.

The Aspen-Birch forest cover type makes up about 45,000 acres. Most stands are a mixture of aspen, paper birch, red maple, and conifers and include a wide range of tree species (fig. 13). Paper birch and aspen are dominant. Other common associated trees include eastern white pine, northern pin oak, eastern hemlock, white spruce, and balsam poplar. Also included are sugar maple, northern red oak, and American elm. Most of the American elm trees have died from Dutch elm disease. This cover type is mainly in areas of the Au Gres, Croswell, Eastport, and Allendale soils. These are sandy and sandy over clayey soils. Tree growth is fair or good on these soils.

The Northern Whitecedar forest cover type makes up about 24,000 acres. Northern whitecedar is the dominant species. Other common associated trees include black spruce, black ash, red maple, eastern hemlock, balsam poplar, and tamarack. This cover type is mainly in areas of the Lupton, Tawas, Leafriver, and Waucedah soils. These are very poorly drained organic soils or very poorly drained, sandy mineral soils. The water table is at or near the surface most of the time. Tree growth is slow. Reestablishing stands of desirable trees in cutover areas is difficult. Windthrow is a serious hazard in areas that are opened up by cutting.

Management for wood crops on the different kinds of soil in the survey area varies but is usually governed by the species present. One management alternative would favor northern hardwood species with an uneven-aged approach. Another management alternative would favor aspen and white birch using an even-aged approach. Management should include considering erosion-control strategies, planting trees where natural regeneration is undesirable or insufficient, controlling vegetation that competes with natural or planted regeneration, improving seedling survival, minimizing windthrow on the wetter sites, harvesting in a timely manner, controlling damage by insects and diseases, removing cull trees and undesirable species, and maintaining the optimum basal area.

Erosion may occur as a result of site preparation for planting or as a result of cutting operations where the soil is exposed along logging roads, stream crossings, and fire lanes and in landing areas. Forests abused by fire may also be subject to erosion. Erosion is generally a hazard on forest land if slopes are 18 percent or more. Establishing logging roads and skid roads on the contour helps to minimize erosion.

Soil wetness is the result of a high water table, flooding, or ponding. Excessive wetness increases the seedling mortality rate, limits the use of equipment, increases the invasion or growth of undesirable plants following harvest, and increases the likelihood of windthrow by restricting the rooting depth of some trees. Ruts form easily on some soils when wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage, damage tree roots, and alter soil structure and can result in a species change and reduced yields. Wetness can be overcome by timing woodland management activities during seasons of the year when the soils are dry or frozen or have adequate snow cover.

Soil droughtiness may also cause seedling mortality. Steep, south- and west-facing slopes may be especially droughty. Planting during periods when soil conditions are moist can minimize seedling losses. Seedling survival during dry seasons can be improved by planting large, vigorous nursery stock or containerized seedlings if natural regeneration is undesirable or insufficient. Special site preparation, such as furrowing to conserve moisture, may also be needed. It may be necessary to use containerized planting stock on very dry sites.

The slope may limit the use of forestry equipment. Slopes of 18 percent or more generally limit the use of equipment in logging areas, on skid trails, and on logging roads. Establishing the logging roads and skid trails on the contour helps to overcome the slope. The slope can also influence the location of landings and log handling areas. Nearly level and undulating areas provide the best locations for such sites.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to

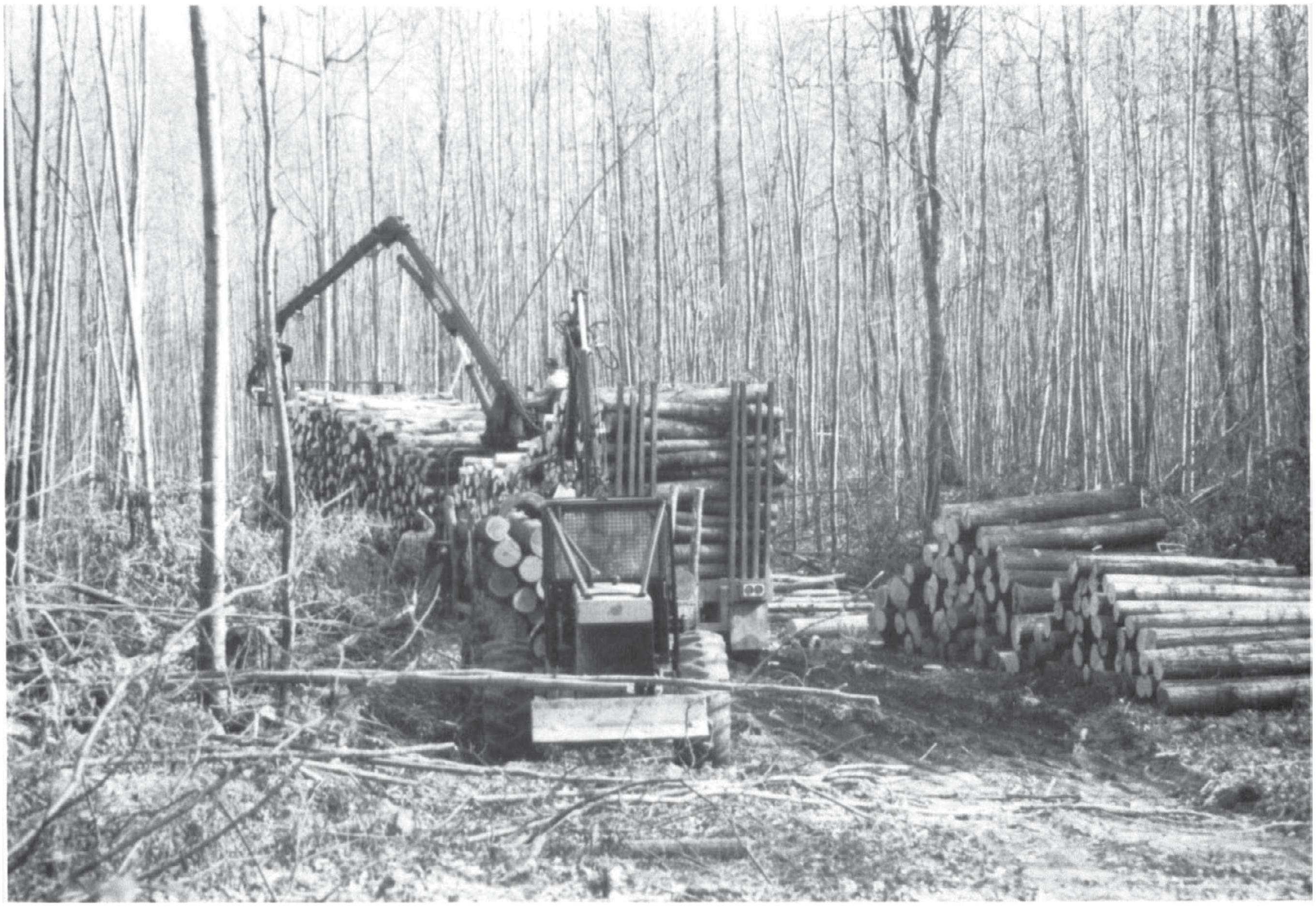

Figure 13.—Aspen for pulp is harvested from an area of Bamfield fine sandy loam, moderately wet, 0 to 6 percent slopes.

11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength in the spring thaw period and during periods of high rainfall. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand. The volume was determined through the use of standard yield tables (USDA, National Forestry Manual).

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Logging and harvesting of wood resources is an important part of the economy of Alcona County. Table 9 provides expanded information concerning the operability of harvesting equipment. The table gives information about operating harvesting or thinning equipment in logging areas and on skid roads, log landings, and haul roads. Limitations are given for the most limiting season and for the preferred operating season. The most limiting season in this survey area generally is spring or late fall. In some areas, however, it is during dry periods in summer, when loose sand can limit trafficability on deep, excessively drained, sandy soils.

The preferred operating season is the period when harvesting or thinning causes the least amount of soil damage. This period generally is when the soil is not too wet or when the ground is frozen or partly frozen or has an adequate snow cover.

In table 9, a rating of *slight* indicates that the use of conventional logging equipment is not restricted if normal logging methods are used. A rating of *moderate* indicates that the use of equipment is restricted because of one or more soil factors. If wetness is a limitation, high flotation equipment or special procedures may be needed to prevent the formation of ruts. A rating of *severe* indicates that the kind of equipment that can be used is seriously restricted.

Logging areas and skid roads include areas where some or all of the trees are being cut. Generally, equipment traffic is least intensive in the logging areas. Skid roads, which generally are within the logging area, are roads or trails over which the logs are dragged or hauled from the stump to a log landing.

Log landings are areas where logs are assembled for transportation. Wheeled equipment may be used more frequently in these areas than in any other areas affected by logging.

Haul roads are access roads leading from primary or surfaced roads to the logging areas. The logging roads serve as transportation routes for wheeled logging equipment and logging trucks. Generally, they are unpaved roads. Some are graveled.

Plant Associations

The Ecological Classification System (ECS) for the Huron-Manistee National Forests (Driscoll and others, 1984) was developed for National Forest System information needs. These include delineating land units for planning analyses, predicting vegetative structure and the distribution of wildlife habitat, planning desired future conditions within and across geologic regions for conservation of biological diversity, and evaluating ecological processes, such as forest succession or soil productivity. The overall purpose of the ECS is to provide an ecological framework for integrated resource planning and management.

The ECS is an ecological approach to defining biological potential of the National Forest land base. Multiple ecological factors were used to define the classification and map units. Climate, landform, soil, and vegetation information was integrated before map units were described and delineated. Information regarding vegetation and soils was predominantly used to delineate map units in the field.

Plant associations are used in the mapping process to help identify local map units. Plant associations are combinations of late successional overstories and groups of associated understory and ground flora species. Species groups are associated with the map unit. However, species composition may vary within the map units, and any given species within a species group may not occur at a particular place. In some cases, the plant association does not reflect soil characteristics and potential. In landscapes that do not support diagnostic plant communities because of natural variability or disturbance, soil and landform variables serve alone as differentiating map unit criteria.

Plant associations have been determined for the map units in the survey area. The primary plant association and secondary plant association are specified at the end of some map unit descriptions under the heading "Detailed Soil Map Units" and are listed in the section "Interpretive Groups." These associations represent the plants that are the most diagnostic for the landforms and soils of the map unit. The following paragraphs describe the plant associations in the survey area. They provide information about the landform and soil type on which the plants occur, the potential late successional overstory and the diagnostic understory, and the ground flora species characteristic of the association.

Plant Association 1—Black oak (Quercus velutina)-White oak (Quercus alba)-Blueberry (Angustifolium)

This association is characteristic of dry, nutrient-poor landscapes in areas of sandy textured soils. Potential late successional natural vegetation includes species that have adapted to harsh conditions and frequent fire disturbance. It is represented by overstory species of black oak (Quercus velutina), white oak (Quercus alba), and northern pin oak (Quercus ellipsoidalis). Distinguishing ground flora and understory species include blueberry (Vaccinium angustifolium), cowwheat (Melampyrum lineare), trailing arbutus (Epigaea repens), huckleberry (Gaylussacia baccata), brackenfern (Pteridium aquilinum), red maple (Acer rubrum) seedlings, and oak (Quercus spp.) seedlings.

Plant Association 2—Mixed oak (Quercus spp.)-Red maple (Acer rubrum)-Starflower (Trientalis borealis)

This association is primarily in areas of sandy soils that exhibit weak spodic development. Potential late successional overstory species include black oak (Quercus velutina), white oak (Quercus alba), northern red oak (Quercus rubra), red maple (Acer rubrum), red pine (Pinus resinosa), and eastern white pine (Pinus strobus). Distinguishing ground flora and understory species include mapleleaf viburnum (Viburnum acerifolium), brackenfern (Pteridium aquilinum), wintergreen (Gaultheria procumbens), starflower (Trientalis borealis), blueberry (Vaccinium angustifolium), red maple (Acer rubrum) seedlings and saplings, and juneberry species (Amelanchier spp.).

Plant association 3—Northern red oak (Quercus rubra)-Red maple (Acer rubrum)-Mapleleaf viburnum (Viburnum acerifolium)

This association is primarily on sandy morainal landscapes and in areas of well developed soils on lake plains. Potential late successional overstory species include northern red oak (Quercus rubra), red maple (Acer rubrum), and eastern white pine (Pinus strobus). Distinguishing ground flora and understory species include mapleleaf viburnum (Viburnum acerifolium), sarsaparilla (Aralia nudicalis), lily-of-the-valley (Maianthemum canadense), largeleaf aster (Aster macrophyllum), squaw root (Conopholis americana), red maple (Acer rubrum) seedlings and saplings, and witchhazel (Hamamelis virginiana).

Plant Association 4—Northern red oak (Quercus rubra)-Red maple (Acer rubrum)-Trefoil (Desmodium spp.)

This association is primarily on moraines and lake beds that have deposits of sand overlying fine-loamy materials. Potential late successional overstory species include northern red oak (Quercus rubra), red maple (Acer rubrum), sugar maple (Acer saccharum), black cherry (Prunus serotina), and white ash (Fraxinus americana). Distinguishing ground flora and understory species include trefoils (Desmodium spp.), downy yellow violet (Viola pubescens), flowering dogwood (Cornus florida), black cherry (Prunus serotina) seedlings, sugar maple (Acer saccharum) seedlings, mapleleaf viburnum (Viburnum acerifolium), and red maple (Acer rubrum) seedlings.

Plant Association 5—Sugar maple (Acer saccharum)-American beech (Fagus grandifolia)-Clubmoss (Lycopodium obscurum, L. lucidulum)

This association is on sandy moraines and sandy lake plains in areas of soils that have dark horizons in the subsoil. Potential late successional overstory species include sugar maple (Acer saccharum), American beech (Fagus grandifolia), northern red oak (Quercus rubra), and red maple (Acer rubrum). The association is characterized by low diversity and coverage of ground flora along the forest floor. Distinguishing understory and ground flora species include lily-of-the-valley (Maianthemum canadense), clubmosses (Lycopodium obscurum and L. lucidulum), true Solomons seal (Polygonatum biflorum), longstalk sedge (Carex pedunculata), and sugar maple (Acer saccharum) seedlings.

Plant Association 6—Sugar maple (Acer saccharum)-White ash (Fraxinus americana)-Sweet cicely (Osmorhiza claytonii)

This association is in areas of coarse over fine textured soils on moraines, till plains, and lake beds. Potential late successional overstory species include sugar maple (Acer saccharum), white ash (Fraxinus americana), American basswood (Tilia americana), eastern hemlock (Tsuga canadensis), black cherry (Prunus serotina), and northern red oak (Quercus rubra). It is characterized by diverse and abundant ground flora on the forest floor. Distinguishing understory and ground flora species include sweet cicely (Osmorhiza claytonii), wild leek (Allium tricoccum), false miterwort (Tiarella cordifolia), true miterwort (Mitella diphylla), Canada white violet (Viola canadensis), bellwort (Uvularia perfoliata), grapefern (Botrychium virginianum), blue cohosh (Caulophyllum thalictroides), sugar maple (Acer saccharum) seedlings, and white ash (Fraxinus americana) seedlings.

Plant Association 7—Northern red oak (Quercus rubra)-Red maple (Acer rubrum)-Leatherleaf (Chamaedaphne calyculata)-Blueberry (Vaccinium angustifolium)

This association is in areas of poorly drained, acidic sand deposits on outwash plains and lake plains. Potential late successional overstory species include northern red oak (Quercus rubra), black oak (Quercus velutina), white oak (Quercus alba), red maple (Acer rubrum), and eastern white pine (Pinus strobus). It is characterized by species adapted to acidic and frequent anaerobic soil conditions. Distinguishing understory and ground flora species include leatherleaf (Chamaedaphne calyculata), blueberry (Vaccinium angustifolium), Labrador tea (Ledum groenlandicum), wintergreen (Gaultheria procumbens), dewberry (Rubus spp.), brackenfern (Pteridium aquilinum), and speckled alder (Alnus rugosa).

Plant Association 8—Red maple (Acer rubrum)-Balsam fir (Abies balsamea)-Bunchberry (Cornus canadensis)

This association is on outwash plains, flood plains, and lake plains in areas of sandy deposits that are slightly acid to alkaline. Potential late successional overstory species include red maple (Acer rubrum), black ash (Fraxinus nigra), green ash (Fraxinus pennsylvanica), balsam fir (Abies balsamea), and eastern white pine (Pinus strobus). Distinguishing understory and ground flora species include lily-of-the-valley (Maianthemum canadense), bunchberry (Cornus canadensis), goldthread (Coptis groenlandica), wintergreen (Gaultheria procumbens), and shield fern (Dryopteris spinulosa).

Plant Association 9—Mixed ash (Fraxinus spp.)-Basswood (Tilia americana)-Downy yellow violet (Viola pubescens)

This association is in areas of poorly drained, nutrient-rich, loamy soils on lake beds, till plains, and flood plains. Organic deposits are shallow. Potential late successional overstory species include American basswood (Tilia americana), eastern hemlock (Tsuga canadensis), black ash (Fraxinus nigra), green ash (Fraxinus pennsylvanica), and white cedar (Thuja occidentalis). Distinguishing understory and ground flora species include downy yellow violet (Viola pubescens), maidenhair fern (Adiantum pedatum), cinnamon fern (Osmunda cinnamomea), jack in the pulpit (Arisaema triphyllum), and bellwort (Uvularia perfoliata).

Plant Association 10—Black spruce (Picea mariana)-Tamarack (Larix laricina)-Labrador tea (Ledum groenlandicum)

This association is in areas of poorly drained, dysic organic deposits on outwash plains and lake plains. The organic deposits are deep. The association is characterized by acid bog conditions. Overstory is sparse with black spruce (Picea mariana) and tamarack (Larix laricina) as the predominant species. Distinguishing understory and ground flora species include Labrador tea (Ledum groenlandicum), leatherleaf (Chamaedaphne calyculata), sphagnum (Sphagnum spp.), and speckled alder (Alnus rugosa).

Plant Association 11—Northern whitecedar (Thuja occidentalis)-Eastern hemlock (Tsuga canadensis)-Canada violet (Viola canadense)

This association is in areas of poorly drained, euic organic deposits on flood plains, till plains, and lake beds. The organic deposits are deep. Potential late successional overstory species include northern whitecedar (Thuja occidentalis), eastern hemlock (Tsuga canadensis), white spruce (Picea glauca), and black ash (Fraxinus nigra). Distinguishing understory and ground flora species include Canada violet (Viola canadense), maidenhair fern (Adiantum pedatum), bedstraws (Galium spp.), and lily-of-the-valley (Maianthemum canadense).

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Recreation is a major land use in Alcona County. Much of the county is used for second home development and for extensive recreational activities, such as fishing, hunting, sightseeing, and wildlife and plant observation. Winter recreation activities include cross-country skiing and snowmobiling. Some areas are dedicated to intensive recreational use. These include campgrounds, a Great Lakes harbor, picnic areas, playgrounds, hiking trails, cross-country skiing areas, and golf courses. Because of increasing population and land prices, land use will likely undergo changes in the future. These changes may include the diversion of more land to various types of recreational uses. The appeal of waterfront property is putting great pressure on the riparian lands of Lake Huron and other water bodies.

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

This section was prepared by Lynn Sampson, biologist, Natural Resources Conservation Service.

Wildlife is a product of the land and depends upon the complex relationship of soil, water, and vegetation for its needs. Wildlife populations are in balance with essential habitat containing food, cover, and water.

Habitat for wildlife in Alcona County is diverse and ranges from heavily wooded areas to open farmland. Alcona County has many streams, inland lakes, and diverse wetlands, all of which support many populations of fish and wildlife.

Before permanent settlement, such wildlife species as black bear, mountain lion, bobcat, and timber wolf roamed the survey area. The passenger pigeon and eastern wild turkey were abundant in the forests of the county.

After logging and agricultural development occurred in the late 1800's, species adapted to second-growth forest, brushy edges, and agricultural areas became abundant. The population of white-tailed deer, red fox, cottontail rabbit, and raccoons increased.

The wooded areas in the county provide important habitat for white-tailed deer (fig. 14), ruffed grouse, and eastern wild turkey. These areas also provide food and cover for black bear, raccoons, skunks, tree squirrels, cardinals, wrens, woodpeckers, and mice. Young stands of jack pine provide important nesting and brooding habitat for the Kirtland's warbler.

The farmed areas and associated idle areas of grass and brush are inhabited by cottontail rabbits, woodchucks, red fox, gray fox, opossum, hawks, owls, and numerous songbirds.

The wooded streams and diverse wetlands provide habitat for blue herons, green herons, bald eagles, belted kingfishers, woodcock, marsh hawks, muskrats, and mink. The streams and lakes support good populations of sunfish, perch, largemouth bass, smallmouth bass, walleye, and northern pike. The rivers and streams are popular among fishermen for trout, salmon, smelt, and steelhead.

The plant and animal communities of Alcona County include many species recognized as rare, threatened, or endangered by the State of Michigan. Included are the common loon, bald eagle, Caspian tern, Kirtland's warbler, channel darter, black sedge, fairy-slipper, pine-drops, and western moonwort.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The

Figure 14.—White-tailed deer find food and cover in areas of Chinwhisker sand, 0 to 4 percent slopes.

kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are buckwheat, corn, wheat, oats, rye, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are orchardgrass, timothy, bromegrass, red clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bunchberry, goldenrod, asters, wild carrot, lambsquarters, and dandelion.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, aspen, cherry, apple, hawthorn, and dogwood. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, and cedar.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are marsh marigold, wild millet, wildrice, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include coyote, meadowlark, field sparrow, cottontail rabbit, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, warblers, woodpeckers, squirrels, gray fox, raccoon, deer, and black bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, wading birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 14 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 14 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification (fig. 15) are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments,

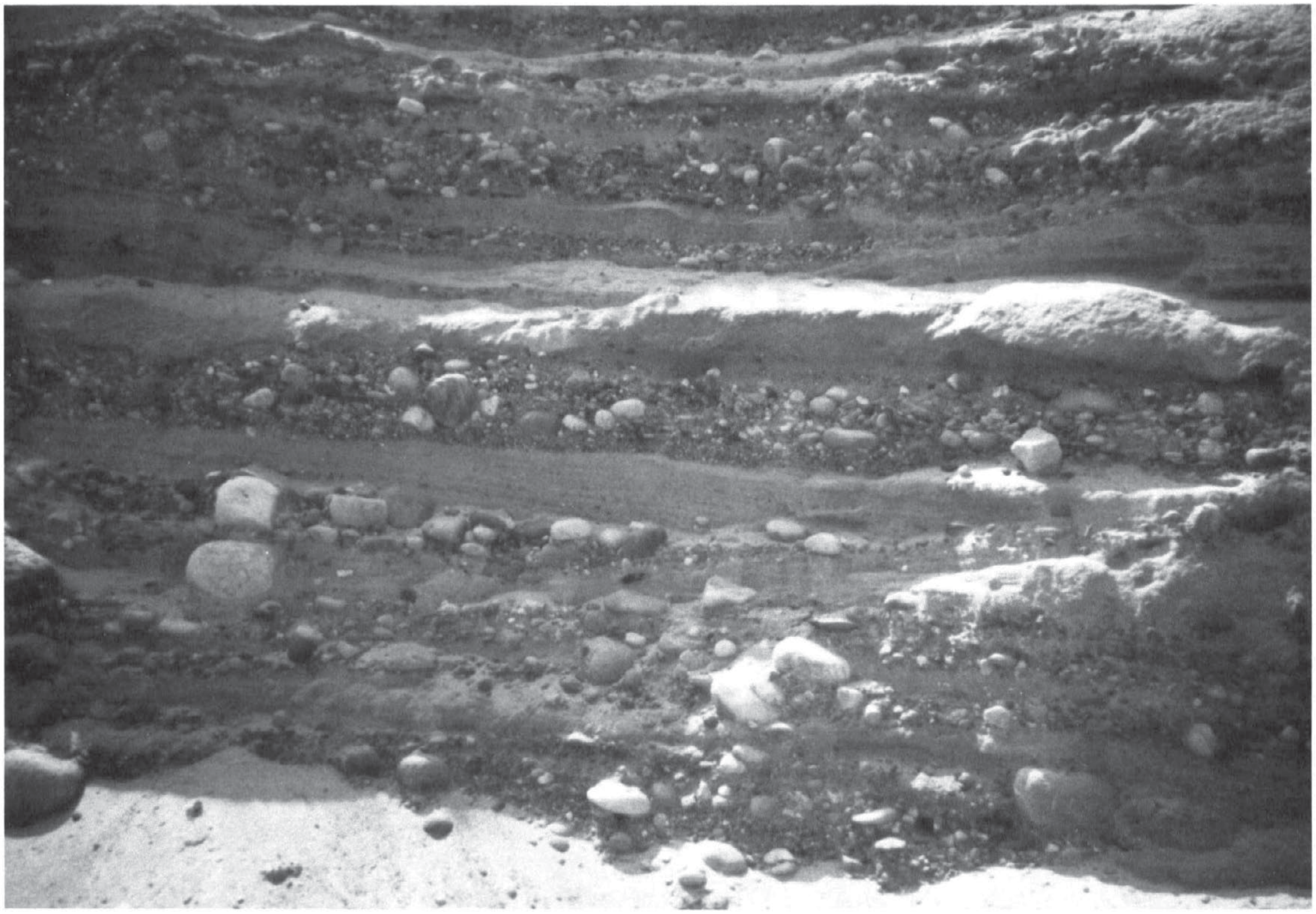

Figure 15.—The stratified substratum in Mancelona soils provides a source of gravel.

slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and bedrock.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table and permeability of the aquifer. The content of large stones affects the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to a cemented pan or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2

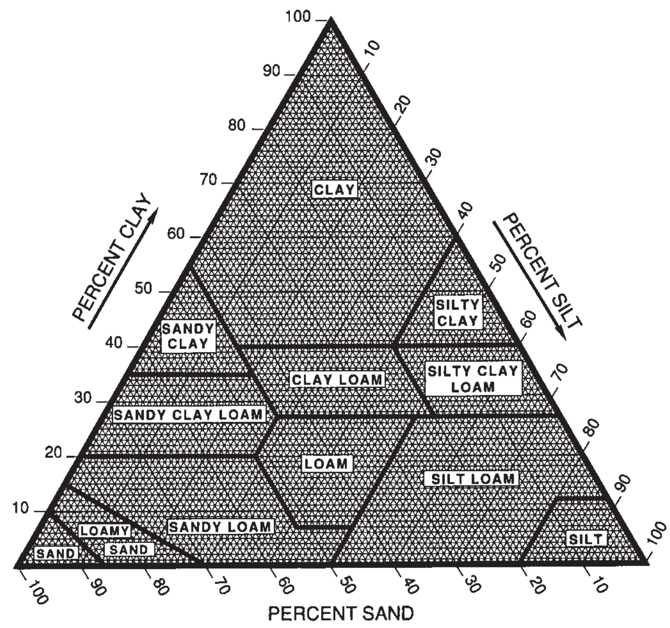

Figure 16.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

millimeters in diameter (fig. 16). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 18 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^1/_3$-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.
8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 18, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Soil and Water Features

Table 19 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 19, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 19 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 19.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

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Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1975; USDA, 1992). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Spodosol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Orthod (*Orth*, meaning the common ones, plus *od*, from Spodosol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplorthods (*Hapl*, meaning minimal horizonation, plus *orthod*, the suborder of the Spodosols that has a horizon characterized by an accumulation of aluminum, iron, and organic carbon in which no one of the elements dominates).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. An example is Alfic Haplorthods.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed, frigid Alfic Haplorthods.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1975). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Alcona Series

The Alcona series consists of moderately well drained and well drained, moderately permeable soils on lake terraces, dissected lake plains, and deltas. These soils formed in stratified sandy and loamy lacustrine and glaciofluvial deposits. Slopes range from 0 to 60 percent.

Typical pedon of Alcona loamy very fine sand, in an area of Zimmerman-Alcona, moderately wet, complex, 6 to 18 percent slopes, 800 feet north and 1,885 feet east of the southwest corner of sec. 9, T. 25 N., R. 9 E.

A—0 to 1 inch; black (N 2/0) loamy very fine sand, dark gray (N 4/0) dry; weak medium granular structure; friable; many clean very fine sand grains; many fine roots; very strongly acid; abrupt smooth boundary.

E—1 to 3 inches; grayish brown (10YR 5/2) loamy very fine sand, light gray (10YR 7/2) dry; weak fine subangular blocky structure; very friable; common fine roots; moderately acid; abrupt wavy boundary.

Bs1—3 to 8 inches; dark brown (7.5YR 4/4) loamy very fine sand; moderate fine subangular blocky structure; very friable; common fine roots; moderately acid; clear wavy boundary.

Bs2—8 to 12 inches; yellowish brown (10YR 5/6) loamy very fine sand; weak fine subangular blocky structure; very friable; common fine roots; moderately acid; clear wavy boundary.

E′—12 to 16 inches; brown (10YR 5/3) loamy very fine sand, very pale brown (10YR 8/3) dry; weak medium subangular blocky structure; friable; few fine roots; moderately acid; clear broken boundary.

B/E—16 to 21 inches; about 80 percent brown (7.5YR 5/4) loam (Bt); moderate medium subangular blocky structure; firm; few fine roots; common discontinuous faint brown (7.5YR 5/4) clay films on faces of peds; surrounded and coated by light yellowish brown (10YR 6/4) very fine sandy loam, very pale brown (10YR 7/4) dry (E); few fine distinct strong brown (7.5YR 5/6) mottles; many very fine vesicular pores; about 2 percent gravel; moderately acid; clear wavy boundary.

Bt—21 to 41 inches; dark brown (7.5YR 4/4) loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine angular blocky structure; firm; few fine roots; many very fine vesicular pores; common continuous faint dark brown (7.5YR 3/4) clay films on faces of peds; about 2 percent gravel; slightly acid; abrupt wavy boundary.

C—41 to 60 inches; light yellowish brown (10YR 6/4) loamy very fine sand; common fine prominent yellowish brown (10YR 5/8) mottles; weak medium platy structure inherent from deposition; friable; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 50 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 5YR to 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3. It is dominantly loamy very fine sand, but the range includes loamy fine sand, very fine sandy loam, or fine sandy loam.

The E horizon has hue of 5YR to 10YR, value of 5 or 6, and chroma of 1 to 3. It is loamy very fine sand, loamy fine sand, or fine sandy loam.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. It is loamy very fine sand, loamy fine sand, very fine sandy loam, or fine sandy loam.

The E′ horizon and the E part of the B/E horizon have hue of 10YR, value of 5 or 6, and chroma of 3 or 4. They are loamy fine sand, fine sandy loam, or very fine sandy loam.

The Bt part of the B/E horizon and the Bt horizon have hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. They are fine sandy loam, very fine sandy loam, or loam.

The C horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 or 4. It is dominantly loamy very fine sand, but in some pedons it has thin strata of loam, very fine sand, and silty clay loam.

Alfic Haplaquods

These soils are classified as mixed, frigid Alfic Haplaquods. Alfic Haplaquods consist of somewhat poorly drained, rapidly permeable soils on outwash plains and lake plains. These soils formed in sandy outwash or lacustrine materials. Slopes range from 0 to 4 percent.

Typically, the A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is sand.

The E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 to 3. It is sand.

The Bs horizons have hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 3 to 6. They are sand or loamy sand.

The E′ horizon has colors similar to those of the E horizon. It is sand.

The Bt horizon has hue of 7.5YR or 10YR, value of

4 to 6, and chroma of 3 to 6. It is loamy sand.

The C horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 2 to 6. It is sand or loamy sand.

Alfic Haplorthods, sandy

These soils are classified as sandy, mixed, frigid Alfic Haplorthods. They are well drained, rapidly permeable soils on end moraines and ground moraines. They formed in sandy and loamy glacial till. Slopes range from 0 to 30 percent.

Reference pedon of Alfic Haplorthods, sandy, in an area of Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy, complex, rolling, approximately 1,150 feet west and 200 feet south of the center of sec. 19, T. 27 N., R. 5 E.

Oe—0 to 2 inches; black (10YR 2/1), partially decomposed hardwood leaf litter.

A—2 to 4 inches; very dark grayish brown (10YR 3/2) loamy sand; weak fine granular structure; very friable; many very fine and fine roots; moderately acid; clear irregular boundary.

E—4 to 7 inches; grayish brown (10YR 5/2) sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine roots; moderately acid; clear irregular boundary.

Bs1—7 to 11 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure; friable; moderately acid; gradual wavy boundary.

Bs2—11 to 32 inches; strong brown (7.5YR 5/6) sand; weak fine subangular blocky structure; very friable; moderately acid; gradual wavy boundary.

Bw—32 to 37 inches; reddish yellow (7.5YR 6/6) sand; single grain; loose; moderately acid; clear irregular boundary.

2Bt—37 to 42 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; very friable; slightly acid; clear wavy boundary.

3C1—42 to 77 inches; reddish yellow (7.5YR 6/6) sand; single grain; loose; neutral; gradual wavy boundary.

3C2—77 to 180 inches; brownish yellow (10YR 6/6) sand; single grain; loose; neutral.

The depth to loamy material ranges from 20 to 45 inches. The content of gravel ranges from 0 to 15 percent throughout the profile.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. It is dominantly loamy sand, but the range includes sand.

The E horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 2 or 3. It is sand or loamy sand. Some pedons have discontinuous E horizons.

The Bs horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is sand or loamy sand. The Bw horizon also is sand or loamy sand.

The 2Bt horizon has hue of 5YR or 7.5YR and value and chroma of 3 to 6. It is sandy loam, fine sandy loam, sandy clay loam, or silt loam. If the 2Bt horizon is above a depth of 40 inches, it is less than 6 inches thick. If it is below a depth of 40 inches, the thickness ranges to 30 inches.

The 3C horizon has hue of 7.5YR or 10YR, value of 6 or 7, and chroma of 3 to 6. It is sand, coarse sand, or loamy sand. Some pedons have bands, less than 6 inches thick, of sandy loam, sandy clay loam, fine sandy loam, silt loam, or silty clay loam.

Alfic Haplorthods, sandy over loamy

These soils are classified as sandy over loamy, mixed, frigid Alfic Haplorthods. They are well drained sandy material overlying loamy and sandy material on ice-contact end moraines and ground moraines. They formed in sandy and loamy glacial till. Permeability is rapid in the sandy material and moderate or moderately slow in the loamy material. Slopes range from 0 to 30 percent.

Reference pedon of Alfic Haplorthods, sandy over loamy, in an area of Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy, complex, rolling, 400 feet north of the center of the NW1/4 of sec. 8, T. 26 N., R. 5 E.

Oe—0 to 2 inches; black (10YR 2/1), partially decomposed hardwood leaf litter.

A—2 to 4 inches; black (10YR 2/1) sand; weak fine granular structure; very friable; many very fine and fine and common medium roots; moderately acid; clear wavy boundary.

E—4 to 6 inches; dark grayish brown (10YR 4/2) sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many very fine and few medium and coarse roots; moderately acid; clear wavy boundary.

Bs1—6 to 9 inches; dark brown (7.5YR 4/4) sand; weak medium granular structure; very friable; many fine and few medium and coarse roots; strongly acid; clear smooth boundary.

Bs2—9 to 27 inches; strong brown (7.5YR 5/6) sand; weak fine granular structure; friable; many very fine and fine and few medium and coarse roots; moderately acid; gradual wavy boundary.

2Bt—27 to 44 inches; brown (7.5YR 5/4) sandy clay loam; moderate medium subangular blocky structure; firm; dark brown (7.5YR 4/4) clay films on faces of peds; common fine roots; neutral; abrupt wavy boundary.

3C1—44 to 52 inches; yellowish brown (10YR 5/6) loamy sand; weak fine granular structure; very friable; neutral; gradual wavy boundary.

3C2—52 to 120 inches; brownish yellow (10YR 6/6) sand; single grain; loose; neutral.

The thickness of the solum ranges from 20 to 50 inches. The thickness of the sandy deposits ranges from 20 to 40 inches. The content of gravel ranges from 0 to 10 percent in the sandy material and from 0 to 15 percent in the Bt and C horizons.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. It is dominantly sand, but the range includes loamy sand.

The E horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 2 to 4. It is sand or loamy sand.

The Bs horizon has hue of 7.5YR or 5YR and value and chroma of 3 to 6. It is sand or loamy sand. Some pedons have a BC horizon of loamy sand or sand as much as 10 inches thick.

The 2Bt horizon has hue of 5YR or 7.5YR and value and chroma of 3 to 6. It is sandy clay loam, clay loam, silt loam, or silty clay loam.

The 3C horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 4 to 6. It is sand, loamy sand, loamy fine sand, fine sand, or sandy loam. Some pedons have strata of sandy clay loam, silt loam, or silty clay loam less than 3 inches thick.

Algonquin Series

The Algonquin series consists of somewhat poorly drained, very slowly permeable soils on lake plains. These soils formed in stratified silty and clayey lacustrine deposits. Slopes range from 0 to 6 percent.

Typical pedon of Algonquin silt loam, in an area of Algonquin-Springport complex, 0 to 6 percent slopes, 1,320 feet south and 150 feet east of the northwest corner of sec. 24, T. 26 N., R. 8 E.

Ap—0 to 7 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; few fine prominent strong brown (7.5YR 5/6) mottles; weak very thick platy structure parting to moderate very fine angular blocky; friable; many very fine and common fine roots; many very fine tubular pores; neutral; abrupt smooth boundary.

Bt1—7 to 11 inches; reddish brown (5YR 4/4) silty clay; common fine prominent gray (10YR 6/1) and strong brown (7.5YR 5/6) mottles; strong very coarse prismatic structure parting to strong fine angular blocky; firm; very dark grayish brown (10YR 3/2) organic coatings on vertical faces of peds; thin patchy pale brown (10YR 6/3) silt coatings on faces of peds; many very fine and common fine roots; many very fine and common medium discontinuous tubular pores; many continuous prominent dark brown (7.5YR 4/2) clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bt2—11 to 14 inches; reddish brown (5YR 5/3) silty clay loam; many medium prominent reddish yellow (7.5YR 6/8) and many medium distinct gray (5YR 6/1) mottles; strong very coarse prismatic structure parting to moderate medium angular blocky; firm; very dark grayish brown (10YR 3/2) organic coatings on vertical faces of peds; few very fine roots; common discontinuous prominent dark brown (10YR 4/3) clay films on faces of peds; slight effervescence; moderately alkaline; clear wavy boundary.

Bt3—14 to 29 inches; light reddish brown (5YR 6/4) silty clay; many medium prominent reddish yellow (7.5YR 6/8) and greenish gray (5GY 6/1) mottles; strong very coarse prismatic structure parting to strong thick platy; firm; very dark grayish brown (10YR 3/2) organic coatings 1 millimeter thick on vertical faces of peds; common prominent dark brown (10YR 4/3) clay films on faces of peds; common white (10YR 8/1) lime or carbonate coatings on faces of peds; strong effervescence; moderately alkaline; clear wavy boundary.

BC—29 to 60 inches; light reddish brown (5YR 6/4) silty clay loam; many medium prominent reddish yellow (7.5YR 6/8) and greenish gray (5GY 6/1) mottles; moderate thick platy structure parting to moderate fine angular blocky; firm; common white (10YR 8/1) lime or carbonate coatings on faces of peds; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 35 to more than 60 inches. The depth to free carbonates ranges from 11 to 15 inches. The content of gravel ranges from 0 to 1 percent throughout the profile.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 1 to 3.

The Bt horizon has hue of 5YR or 7.5YR, value of 3 to 6, and chroma of 3 or 4. It is silty clay or silty clay loam.

The BC horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 4. It is silty clay or silty clay loam, or it is stratified with these textures.

Allendale Series

The Allendale series consists of somewhat poorly drained soils on lake terraces. These soils formed in sandy and clayey lacustrine deposits. Permeability is rapid in the sandy material and very slow in the clayey deposits. Slopes range from 0 to 3 percent.

Typical pedon of Allendale loamy sand, 0 to 3 percent slopes, 675 feet north and 750 feet west of the southeast corner of sec. 7, T. 28 N., R. 8 E.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak coarse granular structure; friable; many fine roots; moderately acid; abrupt smooth boundary.

E—11 to 13 inches; pale brown (10YR 6/3) sand, very pale brown (10YR 7/3) dry; common coarse distinct dark yellowish brown (10YR 4/4) mottles; single grain; loose; few fine roots; common medium cylindrical wormcasts; moderately acid; abrupt broken boundary.

Bs—13 to 20 inches; dark brown (7.5YR 4/4) sand; many medium distinct strong brown (7.5YR 5/8) and common medium prominent grayish brown (10YR 5/2) mottles; weak thick platy structure; friable; few fine roots; few patchy prominent black (N 2/0) manganese or iron-manganese coatings on rock fragments; about 2 percent gravel; moderately acid; abrupt smooth boundary.

E′—20 to 22 inches; yellowish brown (10YR 5/4) sand, very pale brown (10YR 7/4) dry; common medium distinct dark yellowish brown (10YR 4/6) and common medium faint brown (10YR 5/3) mottles; massive; friable; few fine roots; moderately acid; abrupt smooth boundary.

Bt1—22 to 25 inches; reddish brown (5YR 4/4) sandy loam; common medium prominent strong brown (7.5YR 4/6) mottles; massive; friable; few fine roots; many continuous distinct dark brown (7.5YR 4/4) clay bridges between sand grains; slightly acid; abrupt smooth boundary.

2Bt2—25 to 31 inches; reddish brown (5YR 4/3) silty clay; common fine prominent greenish gray (5G 6/1) and strong brown (7.5YR 5/6) mottles; strong medium angular blocky structure; firm; common continuous faint reddish brown (5YR 4/3) clay films on faces of peds; strong effervescence; moderately alkaline; abrupt smooth boundary.

2Bt3—31 to 44 inches; reddish brown (5YR 5/3) silty clay; common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common discontinuous prominent white (5YR 8/1) carbonate coatings on faces of peds; common discontinuous prominent greenish gray (5GY 6/1) clay films on faces of peds; strong effervescence; moderately alkaline; clear smooth boundary.

2BC—44 to 60 inches; reddish brown (5YR 5/3) silty clay; common fine prominent strong brown (7.5YR 5/6) and common fine prominent greenish gray (5GY 6/1) mottles; weak fine angular blocky structure; firm; common discontinuous prominent white (5YR 8/1) carbonate coatings on faces of peds; about 1 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum is greater than 60 inches. The depth to free carbonates ranges from 20 to 45 inches. The thickness of the sandy material ranges from 20 to 40 inches. The content of gravel ranges from 0 to 2 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Some pedons have an A horizon. This horizon has hue of 10YR or is neutral in hue. It has value of 2 and chroma of 0 or 1. It is loamy sand or sand.

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is loamy sand or sand.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. It is loamy sand or sand.

The E′ horizon has hue of 10YR, value of 5 or 6, and chroma of 4.

The Bt horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 4. It is loamy sand or sandy loam.

The 2Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is clay or silty clay.

Aquents

These soils are classified as mixed, frigid Aquents. They are very poorly drained, rapidly permeable to slowly permeable soils on lake plains, outwash plains, and moraines. They formed in sandy to clayey glaciofluvial material. Slopes are 0 to 1 percent.

The surface layer is typically black (10YR 2/1) muck or mucky peat 3 to 16 inches thick.

The upper part of the mineral layers has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 or 2. The lower part has hue of 5YR to 5Y, value of 5 or 6, and chroma of 1 to 3.

The mineral layers range from sand to clay.

Arenic Eutroboralfs

These soils are classified as mixed Arenic Eutroboralfs. They are well drained, moderately permeable or moderately slowly permeable soils on moraines and outwash plains. They formed in sandy and loamy glacial till or outwash material. Slopes range from 0 to 18 percent.

These soils typically have a sandy cap, 20 to 40 inches thick, overlying loamy materials. Stratified materials are commonly below the loamy materials. The content of gravel ranges from 0 to 10 percent.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 1. It is sand or loamy sand.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. It is sand or loamy sand.

The Bs horizons have hue of 7.5YR or 10YR and value and chroma of 4 to 6. They are sand or loamy sand.

The 2Bt horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is sandy loam, fine sandy loam, loam, sandy clay loam, or clay loam.

The 2C horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4. It is sandy loam, fine sandy loam, loam, sandy clay loam, or clay loam.

The 3C horizons are variable in color and texture and are commonly stratified sands, loamy sands, or loams.

Au Gres Series

The Au Gres series consists of somewhat poorly drained, rapidly permeable soils on wave-built terraces and stream terraces. Clayey substratum phases are very slowly permeable in the clayey material. The Au Gres soils formed in sandy glaciofluvial and lacustrine deposits. Slopes range from 0 to 4 percent.

Typical pedon of Au Gres sand (fig. 17), in an area of Tawas-Au Gres complex, 0 to 4 percent slopes, 2,420 feet south and 2,200 feet east of the northwest corner of sec. 3, T. 28 N., R. 9 E.

A—0 to 3 inches; black (N 2/0) sand, black (N 2/0) dry; many pinkish gray (7.5YR 6/2) uncoated sand grains; weak granular structure; very friable; many fine and common medium roots; strongly acid; abrupt smooth boundary.

E—3 to 10 inches; pinkish gray (7.5YR 6/2) sand, pinkish white (7.5YR 8/2) dry; single grain; loose; many fine and common medium roots; strongly acid; abrupt wavy boundary.

Bs1—10 to 14 inches; dark brown (7.5YR 4/4) sand; many fine distinct reddish yellow (7.5YR 6/8) mottles; weak coarse subangular blocky structure; friable; about 40 percent weakly cemented chunks of dark brown (7.5YR 3/4) ortstein; common fine and few medium roots; moderately acid; clear irregular boundary.

Bs2—14 to 27 inches; dark yellowish brown (10YR 4/6) sand; many fine prominent reddish yellow (7.5YR 6/6) and few fine prominent brown (7.5YR 5/2) mottles; single grain; loose; common fine roots; moderately acid; gradual smooth boundary.

BC—27 to 33 inches; yellowish brown (10YR 5/4) sand; common medium distinct brownish yellow (10YR 6/6) and common fine faint brown (10YR 5/3) mottles; single grain; loose; moderately acid; gradual smooth boundary.

C—33 to 60 inches; pale brown (10YR 6/3) sand; few fine prominent reddish yellow (7.5YR 6/8) and few fine faint brown (10YR 5/3) mottles; single grain; loose; neutral.

The thickness of the solum ranges from 20 to 45 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 5YR to 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2.

The E horizon has hue of 5YR to 10YR, value of 5 to 7, and chroma of 1 or 2. It is sand or loamy sand.

The Bs horizon has hue of 5YR to 10YR, value of 3 to 6, and chroma of 4 to 6. It is sand or loamy sand. The content of ortstein ranges from 0 to 50 percent.

The C horizon has hue of 5YR to 10YR, value of 5 or 6, and chroma of 1 to 4.

Silty clay or clay occurs below a depth of 40 inches in the clayey substratum phase. The material has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4.

Ausable Series

The Ausable series consists of very poorly drained soils on flood plains. These soils formed in organic material underlain by sandy alluvial deposits. Permeability is moderate or moderately rapid in the organic part and rapid in the sandy part. Slopes range from 0 to 2 percent.

Typical pedon of Ausable muck, frequently flooded (fig. 18), 10 feet south and 1,660 feet east of the northwest corner of sec. 19, T. 25 N., R. 8 E.

Oa—0 to 8 inches; muck, black (N 2/0) broken face and rubbed; about 10 percent fiber, less than 5 percent rubbed; moderate medium granular structure; friable; primarily herbaceous fibers; many clean sand grains; many fine and medium roots; slightly acid; abrupt smooth boundary.

Cg1—8 to 17 inches; dark grayish brown (2.5Y 4/2) loamy sand; many fine distinct light olive brown (2.5Y 5/6) and common fine distinct dark gray (5Y 4/1) mottles; massive; very friable; bands of black (N 2/0) muck $^1/_{16}$ to $^1/_8$ inch thick; few fine roots; about 5 percent gravel; neutral; abrupt smooth boundary.

Cg2—17 to 35 inches; olive (5Y 5/3) loamy sand; few fine prominent greenish gray (5GY 5/1) mottles; single grain; loose; about 5 percent gravel; neutral; gradual smooth boundary.

Cg3—35 to 80 inches; olive gray (5Y 5/2) sand; single grain; loose; about 5 percent gravel; slight effervescence; slightly alkaline.

Bands of organic material less than 1 inch thick occur within the control section. The content of gravel ranges from 0 to 10 percent throughout the profile.

The Oa horizon and the organic bands have hue of 5YR to 10YR or are neutral in hue. They have value of 2 or 3 and chroma of 0 to 2, unrubbed.

The Cg horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 to 3. It is sand or loamy sand.

Bamfield Series

The Bamfield series consists of well drained and moderately well drained, very slowly permeable soils on disintegration moraines and ground moraines. These soils formed in loamy glacial till. Slopes range from 0 to 45 percent.

Typical pedon of Bamfield fine sandy loam, in an area of Bamfield-Lupton complex, 0 to 45 percent slopes, 2,580 feet south and 500 feet east of the northwest corner of sec. 9, T. 25 N., R. 6 E.

Oe—0 to 1 inch; partially decomposed forest litter; abrupt smooth boundary.

A—1 to 6 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; about 5 percent gravel; very strongly acid; abrupt wavy boundary.

Bw—6 to 11 inches; yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable; few fine roots; common fine tubular pores; about 5 percent gravel; strongly acid; clear wavy boundary.

Ex—11 to 18 inches; pinkish gray (7.5YR 6/2) fine sandy loam, pinkish white (7.5YR 8/2) dry; massive; firm; slightly brittle; few fine roots; common fine tubular pores; about 5 percent gravel; strongly acid; abrupt irregular boundary.

B/E—18 to 21 inches; about 80 percent reddish brown (5YR 4/4) clay loam (Bt); moderate medium subangular blocky structure; firm; few faint dark reddish brown (5YR 3/4) clay films on faces of peds; penetrated by tongues of pinkish gray (7.5YR 6/2) fine sandy loam, pinkish white (7.5YR 8/2) dry (E); moderate medium subangular blocky structure; firm; slightly brittle; few fine roots; about 5 percent gravel; moderately acid; clear irregular boundary.

Bt1—21 to 27 inches; reddish brown (5YR 4/4) clay loam; strong fine angular blocky structure; firm; few fine roots; many faint dark reddish brown (5YR 3/4) clay films on faces of peds; about 5 percent gravel; neutral; abrupt irregular boundary.

Bt2—27 to 31 inches; reddish brown (5YR 5/4) clay loam; weak medium subangular blocky structure; firm; common faint reddish brown (5YR 4/3) clay films on vertical faces of peds; about 5 percent gravel; slight effervescence; moderately alkaline; clear wavy boundary.

BC—31 to 60 inches; light reddish brown (5YR 6/4) clay loam; weak medium subangular blocky structure; very firm; many discontinuous prominent pinkish gray (7.5YR 7/2) calcium carbonate coatings on faces of peds; about 5 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum is greater than 60 inches. The depth to free carbonates ranges from 20 to 35 inches. The content of gravel ranges from 0 to 10 percent throughout the profile, and the content of cobbles ranges from 0 to 3 percent.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. Some pedons have an E horizon. This horizon is fine sandy loam or sandy loam.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is fine sandy loam or sandy loam.

The Ex horizon and the E part of the B/E horizon have hue of 7.5YR or 10YR, value of 6, and chroma of 2 to 4. They are fine sandy loam or sandy loam. Some pedons have mottles in the E part of the B/E horizon, but mottles of low chroma are not present.

The Bt part of the B/E horizon and the Bt horizon have hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4.

The BC horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 4.

Battlefield Series

The Battlefield series consists of somewhat poorly drained soils on lake terraces and outwash plains. These soils formed in sandy and gravelly beach and outwash deposits. Permeability is rapid in the upper part and very rapid in the lower part. Slopes range from 0 to 3 percent.

Typical pedon of Battlefield sand, 0 to 3 percent slopes, 340 feet north and 2,070 feet west of the southeast corner of sec. 10, T. 25 N., R. 9 E.

A—0 to 6 inches; black (N 2/0) sand, gray (10YR 5/1) dry; many pinkish gray (7.5YR 6/2) uncoated sand grains; weak fine granular structure; very friable; many fine roots; about 2 percent gravel; slightly acid; abrupt smooth boundary.

E—6 to 9 inches; pinkish gray (7.5YR 6/2) sand, pinkish white (7.5YR 8/2) dry; single grain; loose; many fine and few medium roots; about 2 percent gravel; moderately acid; abrupt wavy boundary.

Bs1—9 to 10 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure; friable; common medium and fine roots; about 2 percent gravel; moderately acid; abrupt broken boundary.

Bs2—10 to 12 inches; strong brown (7.5YR 4/6) sand; common medium distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; very friable; many fine and common medium roots; about 5 percent gravel; moderately acid; gradual smooth boundary.

Bs3—12 to 26 inches; strong brown (7.5YR 5/6) sand; common medium distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; very friable; many fine roots; about 5 percent gravel; slightly acid; gradual smooth boundary.

BC—26 to 33 inches; brown (10YR 5/3) sand; common fine faint dark grayish brown (10YR 4/2) and common fine distinct yellowish brown (10YR 5/6) mottles; massive; slightly brittle; few fine roots; about 7 percent gravel; neutral; abrupt smooth boundary.

2C—33 to 60 inches; brown (10YR 5/3) gravelly coarse sand; single grain; loose; few fine roots in mat at top of horizon; about 20 percent gravel; violent effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 27 to 35 inches. The content of gravel ranges from 0 to 5 percent in the solum and from 15 to 25 percent in the substratum. The content of cobbles ranges from 0 to 3 percent throughout the profile.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 and chroma of 0 or 1.

The E horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 2. It is loamy sand or sand.

The Bs horizon has hue of 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is loamy sand or sand.

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

Borosaprists

Borosaprists consist of very poorly drained, moderately rapidly permeable to moderately slowly permeable soils on lake plains, outwash plains, and moraines. These soils formed in organic material. Slopes are 0 to 1 percent.

The thickness of the organic materials ranges from 16 to more than 50 inches. The soils are dysic or euic.

The surface texture is typically muck or mucky peat in euic areas and peat in dysic areas. Subsurface layers are dominantly muck. The organic layers have hue of 5YR, 7.5YR, or 10YR, value of 2 to 4, and chroma of 1 to 4. Euic areas have colors that are dominantly black or dark reddish brown. Dysic areas are generally dark brown.

Mineral layers in the substratum have hue of 5YR to 5Y, value of 5 or 6, and chroma of 1 to 3. Textures range from sand to sandy clay loam.

Chinwhisker Series

The Chinwhisker series consists of moderately well drained, rapidly permeable soils on stream terraces, outwash plains, and lake terraces. These soils formed in sandy glaciofluvial and lacustrine deposits. Slopes range from 0 to 4 percent.

Typical pedon of Chinwhisker sand, 0 to 4 percent slopes, 160 feet north and 490 feet east of the southwest corner of sec. 6, T. 28 N., R. 6 E.

A—0 to 2 inches; black (N 2/0) sand, gray (N 5/0) dry; weak fine granular structure; friable; many fine and common medium roots; strongly acid; abrupt smooth boundary.

E—2 to 3 inches; dark grayish brown (10YR 4/2) sand, light gray (10YR 7/2) dry; weak fine granular structure; very friable; many fine roots; strongly acid; abrupt smooth boundary.

Bs1—3 to 8 inches; dark brown (7.5YR 3/4) sand; weak medium subangular blocky structure; friable; common fine and medium roots; about 1 percent gravel; strongly acid; clear smooth boundary.

Bs2—8 to 21 inches; yellowish brown (10YR 5/6) sand; weak fine subangular blocky structure; friable; few fine roots; about 1 percent gravel; moderately acid; abrupt wavy boundary.

E´1—21 to 25 inches; light yellowish brown (10YR 6/4) sand, yellow (10YR 7/6) dry; single grain; loose; few fine roots; moderately acid; abrupt broken boundary.

E´2—25 to 36 inches; light yellowish brown (10YR

6/4) sand, yellow (10YR 7/6) dry; common fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; few fine roots; moderately acid; abrupt smooth boundary.

E and Bt—36 to 80 inches; pale brown (10YR 6/3) sand, light gray (10YR 7/2) dry (E); dark brown (7.5YR 4/4) loamy sand (Bt) occurring as bands 1/16 to 3/4 inch thick with a total accumulation of 4 inches; common fine prominent strong brown (7.5YR 5/8) mottles; single grain; loose; about 1 percent gravel; slightly acid.

The thickness of the solum ranges from 40 to more than 80 inches. The depth to mottles ranges from 20 to 40 inches. The content of gravel ranges from 0 to 15 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2.

The E horizon has hue of 10YR, value of 4 or 5, and chroma of 2.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 to 6. It is sand or loamy sand

The E′ horizon and the E part of the E and Bt horizon have hue of 10YR, value of 5 to 7, and chroma of 3 or 4.

The Bt part of the E and Bt horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It occurs as lamellae 1/16 inch to 2 inches in thickness with a total accumulation of 5 inches or less to a depth of 80 inches.

Colonville Series

The Colonville series consists of somewhat poorly drained, moderately rapidly permeable soils on flood plains. These soils formed in stratified loamy and sandy alluvium. Slopes range from 0 to 3 percent.

The Colonville soils in Alcona County are taxadjuncts because they do not have mottles in the lower part of the A horizon. This difference does not significantly affect use and management.

Typical pedon of Colonville very fine sandy loam, occasionally flooded, 1,975 feet north and 190 feet west of the southeast corner of sec. 15, T. 25 N., R. 8 E.

A—0 to 11 inches; very dark gray (10YR 3/1) very fine sandy loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; many fine and medium roots; slight effervescence; moderately alkaline; clear smooth boundary.

C—11 to 22 inches; yellowish brown (10YR 5/4) and very dark grayish brown (10YR 3/2), stratified loamy fine sand and fine sandy loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium platy fragments; very friable; common medium roots; slight effervescence; moderately alkaline; clear wavy boundary.

Cg1—22 to 38 inches; dark gray (10YR 4/1) and brown (10YR 5/3), stratified fine sandy loam and loamy fine sand; many medium prominent strong brown (7.5YR 5/8) mottles; weak thick platy fragments; very friable; many fine roots; slight effervescence; slightly alkaline; abrupt wavy boundary.

Cg2—38 to 52 inches; very dark grayish brown (10YR 3/2) very fine sand; many medium prominent dark red (2.5YR 3/6) mottles; weak thick platy fragments; friable; many medium roots; many patchy prominent very dark gray (N 3/0) organic coatings throughout; neutral; abrupt wavy boundary.

2Cg3—52 to 60 inches; gray (5Y 6/1) silt loam; many medium prominent yellowish red (5YR 4/6) mottles; massive; friable; neutral.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The C horizons have hue of 7.5YR to 5Y, value of 3 to 6, and chroma of 1 to 6. They are stratified fine sandy loam, sandy loam, and loamy fine sand. Thin layers of silt loam are in most pedons.

Croswell Series

The Croswell series consists of moderately well drained, rapidly permeable soils on stream terraces and lake terraces. Loamy substratum phases have moderately slow permeability in the loamy material. The Croswell soils formed in sandy glaciofluvial and lacustrine deposits. Slopes range from 0 to 6 percent.

Typical pedon of Croswell sand, 0 to 6 percent slopes, 1,330 feet south and 150 feet east of the northwest corner of sec. 28, T. 25 N., R. 9 E.

Oe—0 to 1 inch; black (N 2/0), well decomposed forest litter, black (N 2/0) dry; many fine and medium roots; extremely acid; abrupt smooth boundary.

E—1 to 4 inches; dark grayish brown (10YR 4/2) sand, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; very friable; many fine and medium roots; about 1 percent gravel; very strongly acid; abrupt wavy boundary.

Bs1—4 to 10 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure;

friable; many fine and common medium roots; about 8 percent gravel; very strongly acid; clear wavy boundary.

Bs2—10 to 20 inches; strong brown (7.5YR 5/6) sand; weak coarse subangular blocky structure; very friable; common fine roots; about 3 percent gravel; moderately acid; clear wavy boundary.

BC—20 to 29 inches; brownish yellow (10YR 6/6) sand; many fine faint yellowish brown (10YR 5/6) mottles; single grain; loose; few fine roots; about 3 percent gravel; moderately acid; clear smooth boundary.

C1—29 to 47 inches; yellowish brown (10YR 5/4) sand; many fine and medium prominent strong brown (7.5YR 5/8) mottles; single grain; loose; few medium roots; about 3 percent gravel; slightly acid; abrupt smooth boundary.

C2—47 to 80 inches; light yellowish brown (10YR 6/4) sand; few fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; about 7 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 35 inches. The content of gravel ranges from 0 to 10 percent throughout the profile. The depth to mottles ranges from 20 to 40 inches.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2. Some pedons have an A horizon.

The Bs horizon has hue of 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is sand or loamy sand.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 4.

The loamy substratum phase has stratified sandy loam to silty clay loam below a depth of 40 inches. The material has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4.

Dorval Series

The Dorval series consists of very poorly drained soils on lake plains. These soils formed in decomposed organic material and in the underlying clayey lacustrine deposits. Permeability is moderately rapid or moderate in the organic material and very slow in the clayey deposits. Slopes range from 0 to 2 percent.

Typical pedon of Dorval muck, 1,500 feet south and 50 feet west of the northeast corner of sec. 19, T. 25 N., R. 9 E.

Oa1—0 to 6 inches; muck, black (N 2/0) broken face and rubbed; about 20 percent fiber, 5 percent rubbed; weak fine granular structure; friable; many fine roots; about 5 percent woody fragments; neutral; abrupt smooth boundary.

Oa2—6 to 21 inches; muck, black (N 2/0) broken face and dark reddish brown (5YR 2.5/2) rubbed; about 30 percent fiber, 5 percent rubbed; moderate very thick platy structure; friable; about 15 percent woody fragments; neutral; abrupt smooth boundary.

Oa3—21 to 27 inches; muck, black (N 2/0) broken face and black (5YR 2.5/1) rubbed; about 15 percent fiber, less than 5 percent rubbed; weak thick platy structure; friable; about 5 percent woody fragments; slightly acid; abrupt smooth boundary.

Cg—27 to 60 inches; brown (7.5YR 5/2) silty clay; many fine prominent greenish gray (5G 6/1) and common medium prominent olive brown (2.5Y 4/4) mottles; massive; sticky; about 1 percent gravel; strong effervescence; moderately alkaline.

The depth to the clayey mineral layer ranges from 16 to 45 inches.

The organic material has hue of 5YR or is neutral in hue. It has value of 2, 2.5, or 3 and chroma of 0 to 2.

The Cg horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 1 or 2. It is silty clay or clay.

East Lake Series

The East Lake series consists of somewhat excessively drained soils on lake terraces and outwash plains. These soils formed in sandy and gravelly beach and outwash deposits. Permeability is rapid in the upper part and very rapid in the lower part. Slopes range from 0 to 35 percent.

Typical pedon of East Lake sand, 0 to 6 percent slopes, 2,640 feet north and 525 feet east of the southwest corner of sec. 32, T. 25 N., R. 9 E.

A—0 to 4 inches; black (N 2/0) sand, gray (N 5/0) dry; weak medium granular structure; friable; many fine roots; about 3 percent gravel; slightly acid; abrupt smooth boundary.

E—4 to 7 inches; grayish brown (10YR 5/2) sand, light gray (10YR 7/2) dry; weak medium granular structure; very friable; few medium roots; about 3 percent gravel; slightly acid; clear smooth boundary.

Bs1—7 to 12 inches; dark brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; many fine and common medium roots; about 10 percent gravel and 1 percent cobbles; slightly acid; clear wavy boundary.

Bs2—12 to 20 inches; strong brown (7.5YR 4/6) loamy sand; weak medium subangular blocky structure; very friable; many fine and common medium roots; about 10 percent gravel and 1 percent cobbles; slightly acid; clear wavy boundary.
Bs3—20 to 30 inches; strong brown (7.5YR 5/6) sand; weak medium subangular blocky structure; very friable; common fine and few medium roots; about 12 percent gravel and 1 percent cobbles; neutral; abrupt smooth boundary.
2C—30 to 60 inches; brown (10YR 5/3), stratified sand and very gravelly loamy coarse sand; loose; common fine roots in mat at top of horizon; about 25 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 25 to 40 inches. The content of gravel ranges from 0 to 15 percent in the solum and from 15 to 35 percent in the substratum. The content of cobbles ranges from 0 to 10 percent in the A and E horizons and from 0 to 2 percent throughout the rest of the pedon.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2.

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It is sand or loamy sand.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. It is sand or loamy sand.

The 2C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is stratified sand to very gravelly loamy coarse sand.

Eastport Series

The Eastport series consists of excessively drained, rapidly permeable soils on beach ridges. These soils formed in sandy beach deposits. Slopes range from 0 to 6 percent.

Typical pedon of Eastport sand, 0 to 6 percent slopes, 1,600 feet north and 550 feet west of the southeast corner of sec. 4, T. 28 N., R. 9 E.

A—0 to 1 inch; black (10YR 2/1) sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; common medium and fine roots; moderately acid; abrupt smooth boundary.
E—1 to 8 inches; grayish brown (10YR 5/2) sand, light gray (10YR 7/2) dry; weak medium granular structure; very friable; common medium and fine roots; strongly acid; clear smooth boundary.
Bs1—8 to 14 inches; strong brown (7.5YR 4/6) sand; weak medium subangular blocky structure; very friable; common medium and fine roots; few chunks of dark brown (7.5YR 3/4), weakly cemented ortstein; moderately acid; clear irregular boundary.
Bs2—14 to 23 inches; yellowish brown (10YR 5/6) sand; moderate medium subangular blocky structure; friable; few medium and fine roots; moderately acid; gradual wavy boundary.
BC—23 to 29 inches; very pale brown (10YR 7/4) sand; weak medium subangular blocky structure; friable; slightly acid; gradual wavy boundary.
C—29 to 80 inches; very pale brown (10YR 7/3) sand; single grain; loose; neutral.

The thickness of the solum ranges from 25 to 35 inches. The content of gravel ranges from 0 to 5 percent throughout the pedon.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 2.

The Bs horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 5 or 6.

The C horizon has hue of 10YR, value of 5 to 7, and chroma of 3 or 4.

Ensley Series

The Ensley series consists of poorly drained, moderately permeable soils on till plains and wave-cut platforms. These soils formed in loamy glacial till. Slopes range from 0 to 2 percent.

Typical pedon of Ensley mucky sandy loam, 2,360 feet north and 500 feet west of the southeast corner of sec. 13, T. 28 N., R. 7 E.

A—0 to 8 inches; black (N 2/0) mucky sandy loam, dark gray (N 4/0) dry; weak coarse granular structure; friable; many fine and common medium roots; about 2 percent gravel and 1 percent cobbles; neutral; abrupt smooth boundary.
Bw1—8 to 15 inches; grayish brown (10YR 5/2) sandy loam; many medium prominent yellowish brown (10YR 5/8) and few fine faint gray (10YR 5/1) mottles; weak very thick platy structure parting to weak medium subangular blocky; friable; many fine and common medium roots; many continuous distinct very dark grayish brown (10YR 3/2) organic coatings throughout; about 7 percent gravel and 1 percent cobbles; neutral; abrupt smooth boundary.
Bw2—15 to 29 inches; light reddish brown (5YR 6/3) sandy loam; few fine prominent strong brown (7.5YR 5/6) and many medium prominent light

greenish gray (5GY 7/1) mottles; weak very thick platy structure parting to weak medium subangular blocky; friable; common fine and medium roots; about 7 percent gravel and 1 percent cobbles; moderately alkaline; gradual wavy boundary.

Cg1—29 to 42 inches; pinkish gray (7.5YR 6/2) sandy loam; many coarse prominent yellowish brown (10YR 5/6) mottles; massive; friable; common medium and fine roots; about 5 percent gravel and 1 percent cobbles; slight effervescence; moderately alkaline; gradual wavy boundary.

Cg2—42 to 60 inches; gray (10YR 5/1) sandy loam; massive; friable; few fine roots; about 5 percent gravel and 3 percent cobbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 30 inches. The content of rock fragments ranges from 1 to 10 percent in the solum and from 5 to 15 percent in the substratum.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 and chroma of 0 or 1.

The Bw horizon has hue of 5YR to 10YR, value of 5 or 6, and chroma of 2 or 3.

The Cg horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 or 2.

Entic Haplorthods

These soils are classified as sandy, mixed, frigid Entic Haplorthods. They are excessively drained, rapidly permeable soils on outwash plains, lake plains, and moraines. They formed in sandy glacial drift. Slopes range from 0 to 45 percent.

Reference pedon of Entic Haplorthods, sandy, in an area of Entic Haplorthods, sandy-Alfic Haplorthods, sandy, complex, rolling, 500 feet west and 10 feet south of the northeast corner of sec. 22, T. 26 N., R. 5 E.

Oe—0 to 1 inch; partially decomposed hardwood and coniferous leaf litter.

A—1 to 3 inches; black (10YR 2/1) sand; weak fine granular structure; very friable; many very fine and fine roots; strongly acid; clear wavy boundary.

E—3 to 7 inches; brown (7.5YR 5/3) sand, pinkish gray (7.5YR 6/2) dry; weak fine granular structure; very friable; many very fine, common fine, and few medium roots; strongly acid; clear wavy boundary.

Bs1—7 to 11 inches; dark brown (7.5YR 4/4) sand; weak medium granular structure; very friable; many fine and few medium and coarse roots; strongly acid; clear smooth boundary.

Bs2—11 to 23 inches; strong brown (7.5YR 4/6) sand; weak medium granular structure; very friable; common fine and medium and few coarse roots; strongly acid; clear smooth boundary.

BC—23 to 30 inches; brownish yellow (10YR 6/6) sand; weak fine subangular blocky structure; strongly acid; gradual smooth boundary.

C1—30 to 66 inches; very pale brown (10YR 7/4) sand; single grain; loose; few medium roots; moderately acid; gradual wavy boundary.

C2—66 to 180 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; moderately acid.

The thickness of the solum ranges from 20 to 50 inches. The content of gravel ranges from 0 to 10 percent throughout the solum.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3. It is dominantly sand, but the range includes fine sand and loamy sand.

The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 4. It has textures similar to those of the A horizon.

The Bs horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. It is sand, loamy sand, or fine sand.

The BC horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6.

The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 4 to 6. It is sand or coarse sand. Loamy sand or sandy loam bands are below a depth of 40 inches in the banded substratum phase. Sandy clay loam or clay loam bands are below a depth of 40 inches in the fine-loamy banded substratum phase. Sandy clay loam or clay loam is below a depth of 40 inches in the loamy substratum phase. The gravelly analogs of all of these textures are in some pedons. Mottles are below a depth of 5 feet in the very deep water table phase.

Fluvaquents

These soils are classified as mixed, frigid Fluvaquents. They are poorly drained, rapidly permeable soils on flood plains of lake plains and outwash plains. They formed in sandy alluvial materials. Slopes are 0 to 1 percent.

An organic layer, 2 to 6 inches thick, is typically on the surface. It is typically muck or mucky peat. It has hue of 5YR to 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is sand, loamy sand, or sandy loam.

The C or Cg horizon has hue of 10YR, 2.5YR, or 5Y, value of 4 to 6, and chroma of 2 to 4. It is sand or loamy sand and is commonly stratified with finer textured material.

Glennie Series

The Glennie series consists of well drained and moderately well drained soils on ground moraines. These soils formed in loamy glacial till. Permeability is moderately rapid in the upper part and very slow in the lower part. Slopes range from 0 to 35 percent.

Typical pedon of Glennie loamy sand, moderately wet, 0 to 6 percent slopes, 1,885 feet south and 1,850 feet west of the northeast corner of sec. 13, T. 25 N., R. 6 E.

Oe—0 to 2 inches; partially decomposed forest litter; abrupt smooth boundary.

A—2 to 3 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; many fine roots; about 5 percent gravel; neutral; abrupt smooth boundary.

E—3 to 7 inches; grayish brown (10YR 5/2) loamy sand, light gray (10YR 7/2) dry; weak medium subangular blocky structure; friable; common fine and medium roots; about 5 percent gravel; slightly acid; abrupt broken boundary.

Bt1—7 to 11 inches; dark brown (7.5YR 3/4) sandy loam; moderate medium subangular blocky structure; friable; many fine roots; clay coatings on sand grains and clay bridges between sand grains; about 5 percent gravel and 1 percent cobbles; neutral; abrupt broken boundary.

Bt2—11 to 20 inches; strong brown (7.5YR 4/6) loamy sand; weak medium subangular blocky structure; friable; common fine roots; clay coatings on sand grains and clay bridges between sand grains; about 5 percent gravel; neutral; clear wavy boundary.

(E/B)x—20 to 40 inches; about 60 percent brown (10YR 5/3) loamy sand, very pale brown (10YR 7/3) dry (E); surrounding peds of reddish brown (5YR 5/3) loam (Bt); massive; firm; brittle; few fine roots in cracks; common fine vesicular pores; about 5 percent gravel; neutral; clear irregular boundary.

(B/E)x—40 to 46 inches; about 70 percent reddish brown (5YR 4/4) sandy clay loam (Bt); few faint dark reddish brown (5YR 3/4) clay films; surrounded by brown (10YR 5/3) sandy loam, very pale brown (10YR 7/3) dry (E); few fine prominent strong brown (7.5YR 5/6) mottles; weak thick platy structure; very firm; brittle; common fine roots in cracks; common fine vesicular pores; about 5 percent gravel; slightly acid; clear irregular boundary.

B´t1—46 to 56 inches; dark reddish brown (5YR 3/4) clay; few fine prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very firm; common fine roots between peds; many faint dark reddish brown (5YR 3/4) clay films 1 to 4 millimeters thick on vertical faces of peds; about 5 percent gravel; neutral; clear irregular boundary.

B´t2—56 to 85 inches; reddish brown (5YR 4/4) sandy clay loam; weak medium angular blocky structure; very firm; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; about 8 percent gravel; slight effervescence; slightly alkaline; clear wavy boundary.

Cd—85 to 99 inches; reddish brown (5YR 5/3) sandy clay loam; massive; firm; about 8 percent gravel; strong effervescence; slightly alkaline.

The thickness of the solum is greater than 60 inches. Depth to the fragipan is about 20 to 40 inches. The content of gravel ranges from 0 to 10 percent throughout the profile, and the content of cobbles ranges from 0 to 7 percent. Some pedons do not have mottles in the profile.

The A horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1. Pedons in cultivated areas have an Ap horizon 6 to 9 inches thick. This horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 1 or 2.

The E horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 5 or 6 and chroma of 0 to 3.

The Bt horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 8. It is sandy loam or loamy sand.

The E part of the (E/B)x and (B/E)x horizons has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. It is loamy sand or sandy loam.

The Bt part of the (E/B)x and (B/E)x horizons has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is loam or sandy clay loam.

The B´t horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is clay loam, sandy clay loam, or clay.

The Cd horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4. It is sandy clay loam, clay loam, or loam.

Glossic Eutroboralfs

These soils are classified as mixed Glossic Eutroboralfs. They are well drained, moderately permeable soils on moraines. They formed in loamy and sandy glacial till. Slopes range from 0 to 30 percent.

Typically, the A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. It is dominantly sandy loam, but the range includes loamy sand.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is sandy loam or loamy sand.

The E part of the B/E horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. It is sandy loam or loamy sand.

The Bt part of the B/E horizon and the Bt horizon have hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4. They are sandy clay loam, sandy loam, loam, or clay loam.

The C or 2C horizon has hue of 5YR, 7.5YR, or 10YR, value of 5 or 6, and chroma of 4 to 6. It is loamy sand, sandy loam, loam, sandy clay loam, or clay loam and is commonly stratified.

Graycalm Series

The Graycalm series consists of somewhat excessively drained, rapidly permeable soils on outwash plains and stream terraces. These soils formed in sandy outwash deposits. Slopes range from 0 to 35 percent.

Typical pedon of Graycalm sand, 0 to 6 percent slopes, 2,375 feet north and 150 feet west of the southeast corner of sec. 16, T. 25 N., R. 5 E.

A—0 to 1 inch; black (N 2/0) sand, very dark gray (N 3/0) dry; weak coarse granular structure; friable; many fine roots; about 3 percent gravel; very strongly acid; abrupt smooth boundary.

Bw1—1 to 4 inches; strong brown (7.5YR 4/6) sand; weak fine subangular blocky structure; friable; many fine roots; about 3 percent gravel; very strongly acid; clear wavy boundary.

Bw2—4 to 14 inches; strong brown (7.5YR 5/6) loamy sand; weak fine subangular blocky structure; friable; many fine and common medium roots; about 3 percent gravel; very strongly acid; gradual smooth boundary.

Bw3—14 to 46 inches; strong brown (7.5YR 5/6) loamy sand; weak medium subangular blocky structure; friable; common fine roots; about 3 percent gravel; strongly acid; diffuse smooth boundary.

E and Bt—46 to 80 inches; light yellowish brown (10YR 6/4) sand, very pale brown (10YR 7/4) dry (E); single grain; loose; lamellae of brown (7.5YR 5/4) loamy sand (Bt); clay coatings on sand grains in lamellae; lamellae are 1/4 to 1/2 inch in thickness with a total accumulation of 3 inches; slightly acid.

The thickness of the solum is greater than 60 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1.

The Bw horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is sand or loamy sand.

The E part of the E and Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4.

The Bt part of the E and Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4. It consists of lamellae 1/4 inch to 2 inches thick. The total accumulation within a depth of 80 inches is less than 6 inches.

Grayling Series

The Grayling series consists of excessively drained, rapidly permeable soils on outwash plains and deltas. These soils formed in sandy glaciofluvial deposits. Slopes range from 0 to 35 percent.

Typical pedon of Grayling sand, 0 to 6 percent slopes, 1,100 feet south and 2,000 feet west of the northeast corner of sec. 10, T. 28 N., R. 5 E.

A—0 to 2 inches; black (10YR 2/1) sand, dark gray (10YR 4/1) dry; weak fine granular structure; friable; many fine roots; about 1 percent gravel; very strongly acid; abrupt smooth boundary.

Bw1—2 to 4 inches; dark yellowish brown (10YR 4/4) sand; very weak medium subangular blocky structure; friable; many fine and common medium roots; about 1 percent gravel; very strongly acid; clear wavy boundary.

Bw2—4 to 19 inches; yellowish brown (10YR 5/4) sand; very weak medium subangular blocky structure; very friable; common fine roots; about 1 percent gravel; strongly acid; clear wavy boundary.

BC—19 to 29 inches; yellowish brown (10YR 5/4) sand; single grain; loose; few fine roots; about 1 percent gravel; strongly acid; clear wavy boundary.

C1—29 to 63 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; about 3 percent gravel; moderately acid; abrupt wavy boundary.

C2—63 to 80 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; about 3 percent gravel; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 35 inches. Some areas do not have free carbonates within a depth of 180 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 and chroma of 0 or 1.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is sand or stratified sand and coarse sand.

Thin lamellae or bands of loamy sand or loamy fine sand occur below a depth of 60 inches in the banded substratum phase.

Haplaquods

These soils are classified as mixed, frigid Haplaquods. They are poorly drained, rapidly permeable soils on lake plains and outwash plains. They formed in sandy lacustrine or outwash material. Slopes range from 0 to 2 percent.

An organic surface layer, 1 to 4 inches thick, is typically on the surface. It is dominantly muck or mucky peat. It has hue of 5YR to 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is sand or loamy sand.

The E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 or 2. It is sand or loamy sand.

The B horizons have hue of 5YR to 10YR, value of 3 or 4, and chroma of 3 to 6. They are sand or loamy sand.

The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 4. It is sand or loamy sand.

Histosols

Histosols consist of very poorly drained, moderately rapidly permeable to moderately slowly permeable soils on lake plains, outwash plains, and moraines. These soils formed in organic material. Slopes are 0 to 1 percent.

The thickness of the organic material ranges from 16 to more than 50 inches. Surface horizons are dominantly muck or mucky peat, but the range includes peat. Subsurface horizons are dominantly muck, but the range includes mucky peat. The organic material typically has hue of 5YR, 7.5YR, or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3. The mineral horizons in the substratum range from sand to clay. They have hue of 5YR to 5Y, value of 5 or 6, and chroma of 1 to 3.

Hoist Series

The Hoist series consists of moderately well drained and well drained soils on till plains and drumlins. These soils formed in loamy glacial till. Permeability is moderately rapid in the upper part of the profile, moderately slow in the next part, and very slow in the lower part. Slopes range from 0 to 18 percent.

Typical pedon of Hoist sandy loam, moderately wet, 6 to 12 percent slopes, 2,300 feet south and 360 feet west of the northeast corner of sec. 7, T. 27 N., R. 9 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) sandy loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable; many fine roots; about 5 percent gravel and 2 percent cobbles; slightly acid; abrupt smooth boundary.

Bw—9 to 14 inches; yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; friable; many fine roots; about 5 percent gravel and 2 percent cobbles; neutral; clear wavy boundary.

E/B—14 to 21 inches; about 60 percent brown (7.5YR 5/4) sandy loam, pinkish gray (7/5YR 7/2) dry (E); occurring as tongues extending into and surrounding peds of reddish brown (5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; many fine roots; about 5 percent gravel and 2 percent cobbles; neutral; clear wavy boundary.

Bt1—21 to 27 inches; reddish brown (5YR 4/4) loam; strong medium subangular blocky structure; firm; few fine roots between peds; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; about 2 percent gravel and 2 percent cobbles; slightly alkaline; abrupt wavy boundary.

Bt2—27 to 49 inches; light reddish brown (5YR 6/3) sandy loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak thick platy structure; firm; few fine roots between peds; common very fine vesicular pores; few distinct reddish brown (5YR 5/4) clay films on vertical faces of peds; about 7 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

Cd—49 to 80 inches; light reddish brown (5YR 6/3) sandy loam; massive; weakly expressed plates inherited from the parent material; very firm; about 7 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to dense glacial till range from 40 to 50 inches. The content of gravel ranges from 2 to 10 percent in the solum and from 5 to 10 percent in the substratum. The content of cobbles ranges from 0 to 5 percent throughout the profile. Some pedons do not have high-chroma mottles in the profile.

The Ap horizon has hue of 7.5YR or 10YR, value of 3, and chroma of 1 or 2. Some pedons have an A horizon. This horizon has hue of 5YR to 10YR or is neutral in hue. It has value of 3 and chroma of 0 to 2.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6.

The E part of the E/B horizon has hue of 10YR, 7.5YR, or 5YR, value of 5 or 6, and chroma of 2 to 4. It is loamy sand or sandy loam.

The Bt part of the E/B horizon and the Bt horizon have hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. They are sandy loam or loam.

The Cd horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4.

Kawkawlin Series

The Kawkawlin series consists of somewhat poorly drained, slowly permeable soils on till plains. These soils formed in loamy glacial till. Slopes range from 1 to 4 percent.

Typical pedon of Kawkawlin loam, 1 to 4 percent slopes, 340 feet south and 675 feet east of the northwest corner of sec. 15, T. 28 N., R. 8 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure; friable; about 5 percent gravel; neutral; abrupt smooth boundary.

B/E—10 to 13 inches; about 80 percent dark brown (7.5YR 4/4) clay loam (Bt); surrounded by brown (10YR 5/3) loam, very pale brown (10YR 7/3) dry (E); common fine distinct strong brown (7.5YR 5/6) and few fine prominent grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few patchy faint dark brown (7.5YR 4/4) clay flows; about 5 percent gravel; common very dark grayish brown (10YR 3/2) wormcasts; common fine roots; neutral; abrupt broken boundary.

Bt—13 to 16 inches; strong brown (7.5YR 4/6) clay loam; many fine faint strong brown (7.5YR 5/6) and common fine prominent grayish brown (10YR 5/2) mottles; strong fine angular blocky structure; firm; many fine roots between peds; many continuous distinct brown (7.5YR 5/2) clay films on faces of peds; many continuous distinct dark brown (7.5YR 4/4) clay films on faces of peds; many medium cylindrical wormcasts; about 5 percent gravel; neutral; clear smooth boundary.

BC—16 to 30 inches; strong brown (7.5YR 4/6) clay loam; many fine faint strong brown (7.5YR 5/6) and common fine prominent grayish brown (10YR 5/2) mottles; moderate medium angular blocky structure; friable; few fine roots between peds; about 5 percent gravel; slightly alkaline; abrupt smooth boundary.

C—30 to 60 inches; reddish brown (5YR 5/3) clay loam; common coarse prominent strong brown (7.5YR 5/6) and common coarse prominent light greenish gray (5GY 7/1) mottles; weak medium prismatic structure; very firm; about 5 percent gravel and 1 percent cobbles; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 20 to 35 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

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

The E part of the B/E horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3.

The Bt part of the B/E horizon and the Bt horizon have hue of 5YR or 7.5YR, value of 4, and chroma of 4 to 6. They are clay loam or clay.

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

Killmaster Series

The Killmaster series consists of somewhat poorly drained soils on ground moraines and drumlins. These soils formed in loamy glacial till. Permeability is moderate in the solum and very slow in the substratum. Slopes range from 0 to 3 percent.

Typical pedon of Killmaster sandy loam, 0 to 3 percent slopes, 2,220 feet north and 200 feet east of the southwest corner of sec. 9, T. 27 N., R. 9 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; friable; common fine and medium roots; about 5 percent gravel and 2 percent cobbles; strongly acid; abrupt smooth boundary.

E—8 to 13 inches; brown (7.5YR 5/2) sandy loam, pinkish gray (7.5YR 7/2) dry; few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; about 5 percent gravel and 2 percent cobbles; moderately acid; clear wavy boundary.

E/B—13 to 20 inches; about 60 percent brown (7.5YR

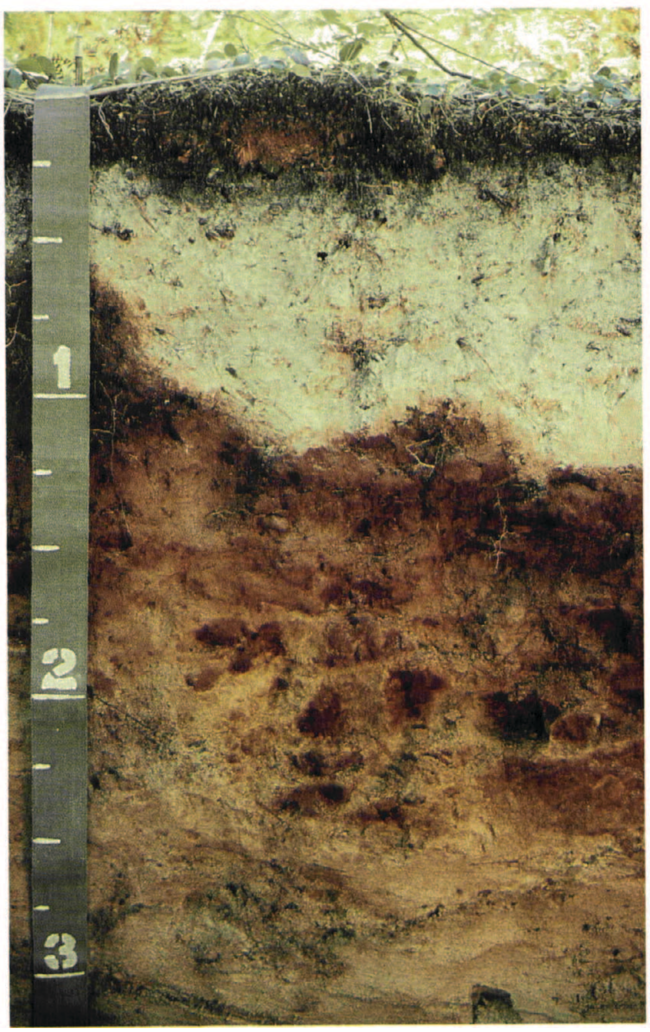

Figure 17.—Typical profile of Au Gres sand. The B horizon is mottled throughout. Depth is marked in feet.

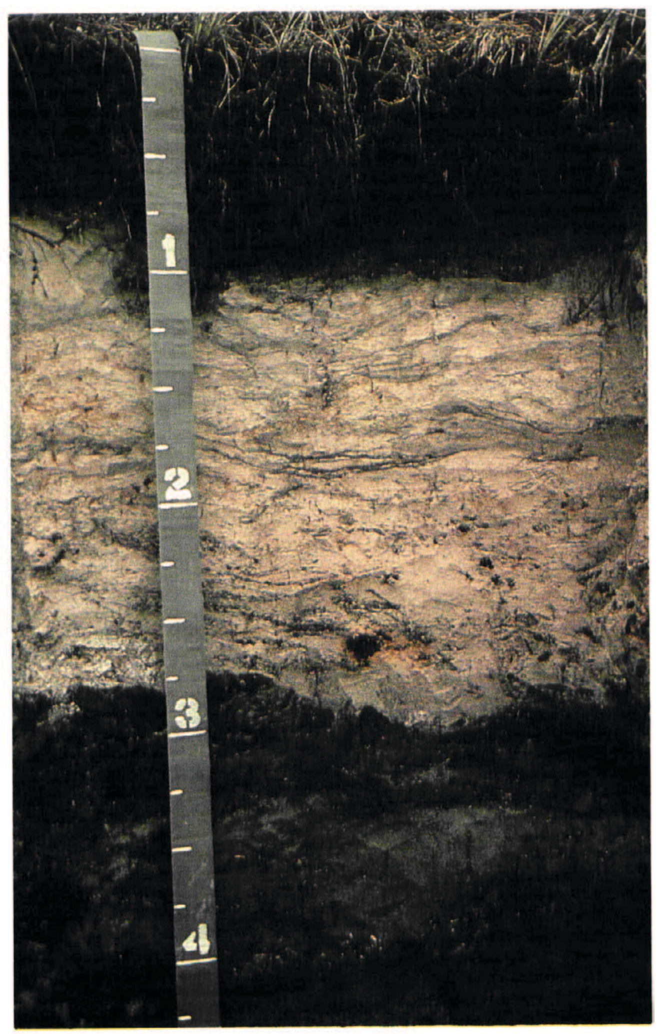

Figure 18.—Typical profile of Ausable muck. This soil formed in alternate layers of sand and muck on flood plains. Depth is marked in feet.

Figure 19.—Typical profile of Klacking loamy sand. The darker material below a depth of 2 feet is Bt material. The lighter colored material is E′ material. Depth is marked in feet.

Figure 20.—Typical profile of Leafriver muck. This soil has a histic epipedon. Depth is marked in feet.

Figure 21.—Typical profile of Mancelona loamy sand. The C horizon is at a depth of about 24 inches. Depth is marked in feet.

Figure 22.—Typical profile of Manistee loamy sand. The very slowly permeable clay causes a seasonally perched water table. Depth is marked in feet.

Figure 23.—Typical profile of McGinn loamy sand. The sandy cap is about 15 inches thick. Depth is marked in feet.

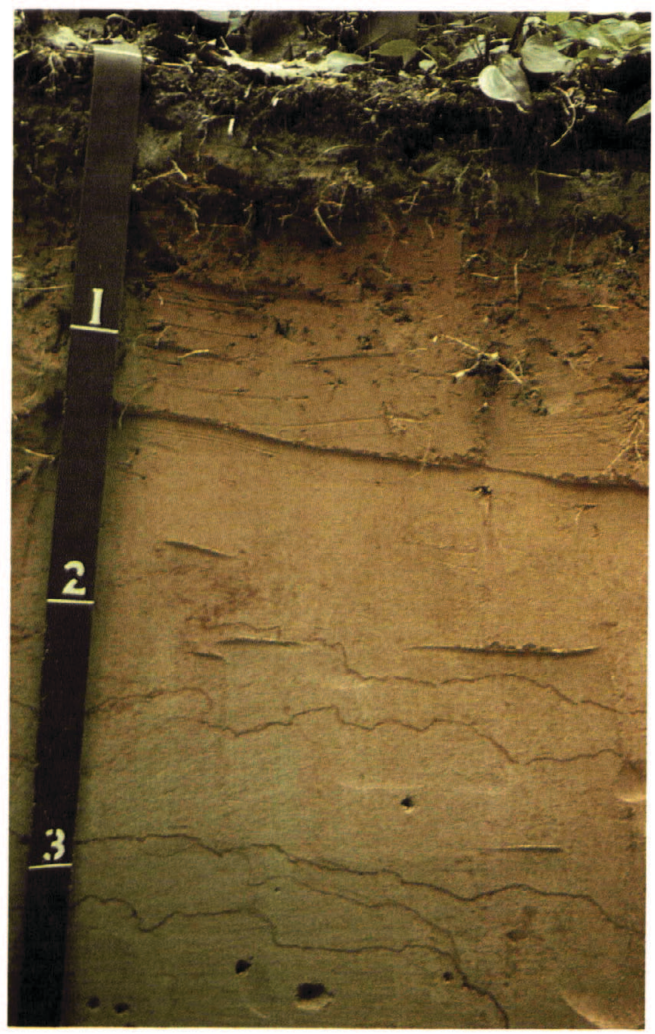

Figure 24.—Typical profile of Zimmerman loamy fine sand. Thin lamellae are below a depth of 24 inches. Depth is marked in feet.

5/2) loamy sand, pinkish gray (7.5YR 7/2) dry (E); surrounding peds of dark brown (7.5YR 4/4) sandy loam (Bt); few medium distinct strong brown (7.5YR 5/6) and common fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; common distinct reddish brown (5YR 5/4) clay films on faces of peds; about 5 percent gravel and 2 percent cobbles; slightly acid; clear irregular boundary.

B/E—20 to 23 inches; about 70 percent dark brown (7.5YR 4/4) sandy loam (Bt); penetrated by tongues of brown (7.5YR 5/2) loamy sand, pinkish gray (7/5YR 7/2) dry (E); common medium distinct strong brown (7.5YR 5/6) and common fine prominent grayish brown (10YR 5/2) mottles; strong medium subangular blocky structure; firm; few fine and medium roots; common distinct dark reddish brown (5YR 3/3) clay films on faces of peds; about 5 percent gravel and 2 percent cobbles; slightly acid; clear irregular boundary.

Bt—23 to 32 inches; dark brown (7.5YR 4/4) sandy loam; few medium distinct strong brown (7.5YR 4/6) and few fine prominent brown (7.5YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine and medium roots; common faint dark brown (7.5YR 4/4) clay films on faces of peds; about 5 percent gravel and 2 percent cobbles; slightly acid; clear wavy boundary.

Cd—32 to 80 inches; brown (7.5YR 5/4) sandy loam; few medium distinct reddish yellow (7.5YR 6/6) mottles along fracture planes; massive with weakly expressed platiness inherited from the parent material; very firm; few patchy distinct pinkish gray (7.5YR 7/2) carbonate coatings along fracture planes; about 10 percent gravel and 5 percent cobbles; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to dense glacial till range from 20 to 40 inches. The depth to free carbonates also ranges from 20 to 40 inches. The content of gravel ranges from 2 to 10 percent in the solum and from 5 to 10 percent in the substratum. The content of cobbles ranges from 0 to 5 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 3, and chroma of 2 or 3. Some pedons have an A horizon. This horizon has hue of 10YR or is neutral in hue. It has value of 2 and chroma of 0 or 1.

The E horizon and the E part of the E/B and B/E horizons have hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 or 3. They are sandy loam or loamy sand.

The Bt part of the E/B and B/E horizons and the Bt horizon have hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. They are sandy loam or loam.

The Cd horizon has hue of 7.5YR, 10YR, or 5YR, value of 5 or 6, and chroma of 3 or 4. This horizon limits the penetration of roots, except in fracture planes and cracks.

Kinross Series

The Kinross series consists of very poorly drained, rapidly permeable soils on lake plains and outwash plains. These soils formed in sandy lacustrine and outwash deposits. Slopes are 0 to 1 percent.

Typical pedon of Kinross muck, 580 feet south and 410 feet east of the northwest corner of sec. 31, T. 25 N., R. 9 E.

Oa—0 to 3 inches; black (N 2/0) muck; weak thick platy structure; friable; many fine and common medium roots; strongly acid; abrupt wavy boundary.

Eg—3 to 8 inches; pinkish gray (7.5YR 6/2) fine sand, pinkish white (7.5YR 8/2) dry; few fine prominent dark gray (10YR 4/1) mottles; single grain; nonsticky; many fine and few medium roots; strongly acid; clear wavy boundary.

Bhs—8 to 14 inches; dark reddish brown (5YR 3/2) fine sand; common fine distinct yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; nonsticky; about 40 percent chunks of dark reddish brown (5YR 3/2), strongly cemented ortstein; few fine roots; very strongly acid; clear wavy boundary.

Bs1—14 to 22 inches; dark brown (7.5YR 3/4) fine sand; few medium distinct dark brown (7.5YR 3/2) mottles; weak medium subangular blocky structure; nonsticky; about 20 percent weakly cemented ortstein; few fine roots; strongly acid; gradual wavy boundary.

Bs2—22 to 26 inches; dark yellowish brown (10YR 4/6) fine sand; few medium prominent dark brown (7.5YR 4/2) mottles; single grain; nonsticky; moderately acid; gradual wavy boundary.

BC—26 to 30 inches; yellowish brown (10YR 5/6) fine sand; single grain; nonsticky; moderately acid; gradual wavy boundary.

Cg—30 to 60 inches; light brownish gray (10YR 6/2) fine sand; single grain; nonsticky; moderately acid.

The thickness of the solum ranges from 25 to 45 inches.

The Oa horizon has hue of 5YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2.

The E horizon has hue of 7.5YR or 10YR, value of 6, and chroma of 2 or 3. It is fine sand or sand.

The Bhs horizon has hue of 5YR, 7.5YR, or 10YR and value and chroma of 2 or 3. It is fine sand or sand.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 4 to 6. It is fine sand or sand.

The Cg horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 or 3. It is fine sand or sand.

Klacking Series

The Klacking series consists of well drained, moderately rapidly permeable soils on disintegration moraines and outwash plains. These soils formed in sandy and loamy glacial drift. Slopes range from 0 to 50 percent.

Typical pedon of Klacking loamy sand (fig. 19), in an area of Klacking-McGinn loamy sands, 8 to 50 percent slopes, dissected, 710 feet south and 1,880 feet west of the northeast corner of sec. 20, T. 28 N., R. 7 E.

A—0 to 2 inches; black (N 2/0) loamy sand, dark gray (N 4/0) dry; weak fine granular structure; very friable; many fine and medium roots; about 5 percent gravel; strongly acid; abrupt smooth boundary.

E—2 to 3 inches; brown (10YR 5/3) loamy sand, light gray (10YR 7/2) dry; weak fine granular structure; very friable; many fine and medium roots; about 5 percent gravel; strongly acid; abrupt smooth boundary.

Bw1—3 to 19 inches; dark yellowish brown (10YR 4/6) loamy sand; weak medium subangular blocky structure; very friable; many fine and medium roots; about 5 percent gravel; moderately acid; gradual wavy boundary.

Bw2—19 to 27 inches; yellowish brown (10YR 5/6) loamy sand; weak medium granular structure; very friable; many fine and medium roots; about 5 percent gravel; moderately acid; gradual wavy boundary.

E and Bt—27 to 40 inches; light yellowish brown (10YR 6/4) loamy sand, very pale brown (10YR 7/4) dry (E); weak coarse granular structure; lamellae of dark brown (7.5YR 4/4) sandy loam (Bt) 1 to 2 inches thick with a total accumulation of 7 inches; moderate medium subangular blocky structure; friable; many fine roots; slightly acid; abrupt wavy boundary.

B/E—40 to 46 inches; about 60 percent dark brown (7.5YR 4/4) sandy loam (Bt); moderate medium subangular structure; surrounded by light yellowish brown (10YR 6/4) loamy sand, very pale brown (10YR 7/4) dry (E); weak coarse granular structure; friable; many fine roots; slightly acid; abrupt wavy boundary.

E´ and B´t—46 to 60 inches; light yellowish brown (10YR 6/4) loamy sand, very pale brown (10YR 7/4) dry (E´); weak coarse granular structure; lamellae of dark brown (7.5YR 4/4) sandy loam (B´t) 1/2 to 1 inch thick with a total accumulation of 4 inches; moderate medium subangular blocky structure; friable; many fine roots; slightly acid.

The thickness of the solum and the depth to free carbonates range from 40 to more than 60 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1.

The E horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. It is loamy sand or sand.

The E part of the E and Bt and B/E horizons has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is loamy sand or sand.

The Bt part of the E and Bt and B/E horizons has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6.

The C horizon, if it occurs, has hue of 10YR, value of 5 or 6, and chroma of 3 or 4.

Leafriver Series

The Leafriver series consists of very poorly drained, rapidly permeable soils on lake plains and outwash plains. These soils formed in sandy lacustrine and outwash deposits. Slopes are 0 to 1 percent.

Typical pedon of Leafriver muck (fig. 20), 1,860 feet east and 100 feet north of the southwest corner of sec. 14, T. 28 N., R. 9 E.

Oa—0 to 9 inches; muck, black (N 2/0) broken face, pressed, and rubbed; about 15 percent fiber, less than 5 percent rubbed; weak medium granular structure; friable; many fine and few medium roots; slightly acid; abrupt smooth boundary.

Bw—9 to 21 inches; brown (10YR 5/3) sand; common medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; few fine roots; neutral; clear smooth boundary.

Cg1—21 to 27 inches; grayish brown (10YR 5/2) sand; common medium distinct yellowish brown (10YR 5/4) mottles; single grain; loose; about 10 percent gravel and 5 percent cobbles; strong effervescence; slightly alkaline; gradual wavy boundary.

Cg2—27 to 60 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; strong effervescence; slightly alkaline.

The thickness of the solum ranges from 10 to 25 inches. The depth to free carbonates is greater than 20 inches. The content of gravel ranges from 0 to 15 percent throughout the profile.

The Oa horizon has hue of 10YR or is neutral in hue. It has value of 2 and chroma of 0 or 1.

The Bw horizon has hue of 10YR, value of 3 to 5, and chroma of 3. It is sand or loamy sand.

The Cg horizon has hue of 10YR, 5Y, 5GY, or 2.5Y, value of 4 to 6, and chroma of 1 or 2.

Loxley Series

The Loxley series consists of very poorly drained, moderately slowly permeable to moderately rapidly permeable soils in depressions on lake plains and outwash plains. These soils formed in organic soil material. Slopes are 0 to 1 percent.

Typical pedon of Loxley peat, 2,350 feet north and 410 feet west of the southeast corner of sec. 7, T. 27 N., R. 9 E.

Oi—0 to 18 inches; peat, dark brown (7.5YR 3/4) broken face, brown (10YR 5/3) rubbed; about 80 percent fiber, 45 percent rubbed; weak thick platy structure; friable; primarily herbaceous fibers; common medium roots; ultra acid; abrupt smooth boundary.

Oa1—18 to 28 inches; muck, dark brown (7.5YR 3/2) broken face, black (5YR 2.5/1) rubbed; about 65 percent fiber, 10 percent rubbed; weak thick platy structure; friable; primarily herbaceous fibers; ultra acid; abrupt smooth boundary.

Oa2—28 to 60 inches; muck, black (5YR 2.5/2) broken face and rubbed; about 40 percent fiber, 5 percent rubbed; weak thick platy structure; friable; primarily herbaceous fibers; 10 percent wood fragments; ultra acid.

The organic layers are 60 inches or more thick. The organic material has hue of 5YR, 7.5YR, or 10YR, value of 2 to 5, and chroma of 1 to 4.

Lupton Series

The Lupton series consists of very poorly drained, moderately slowly permeable to moderately rapidly permeable soils in depressions on lake plains, outwash plains, and till plains. These soils formed in organic soil material. Slopes range from 0 to 2 percent.

Typical pedon of Lupton muck, 150 feet north and 2,150 feet east of the southwest corner of sec. 16, T. 25 N., R. 9 E.

Oa1—0 to 5 inches; muck, black (N 2/0) broken face and rubbed; about 70 percent fiber, less than 5 percent rubbed; weak medium granular structure; friable; common fine roots; primarily woody fibers; about 20 percent wood fragments; slightly alkaline; abrupt smooth boundary.

Oa2—5 to 30 inches; muck, dark reddish brown (5YR 3/2) broken face and rubbed; about 60 percent fiber, about 7 percent rubbed; weak thick platy structure; friable; few fine roots; primarily woody fibers; about 10 percent wood fragments; slightly alkaline; abrupt smooth boundary.

Oa3—30 to 42 inches; muck, dark reddish brown (5YR 2.5/2) broken face and rubbed; about 10 percent fiber, less than 5 percent rubbed; massive; friable; primarily woody fibers; slightly alkaline; abrupt smooth boundary.

Oa4—42 to 60 inches; muck, dark reddish brown (5YR 3/2) broken face and rubbed; about 25 percent fiber, less than 5 percent rubbed; massive; friable; primarily herbaceous fibers; slightly alkaline.

The organic layers are more than 60 inches thick. The organic material has hue of 5YR, 7.5YR, or 10YR or is neutral in hue. It has value of 2, 2.5, or 3 and chroma of 0 to 3.

Mancelona Series

The Mancelona series consists of somewhat excessively drained soils on stream terraces and glacial drainageway terraces. These soils formed in sandy and loamy outwash materials underlain by stratified sandy and gravelly outwash deposits. Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Slopes range from 0 to 35 percent.

Typical pedon of Mancelona loamy sand, 0 to 6 percent slopes (fig. 21), 2,490 feet north and 1,990 feet west of the southeast corner of sec. 16, T. 25 N., R. 5 E.

A—0 to 2 inches; black (N 2/0) loamy sand, very dark gray (N 3/0) dry; weak coarse granular structure; friable; many fine and few medium roots; about 9 percent gravel; strongly acid; abrupt smooth boundary.

E—2 to 5 inches; dark grayish brown (10YR 4/2) loamy sand, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; friable; many fine and few medium roots; about 9 percent gravel; very strongly acid; abrupt wavy boundary.

Bs1—5 to 16 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium subangular blocky structure; friable; many fine roots; about 9 percent gravel; moderately acid; clear wavy boundary.

Bs2—16 to 31 inches; yellowish brown (10YR 5/6) sand; weak fine subangular blocky structure; friable; common fine roots; about 9 percent gravel; slightly acid; abrupt smooth boundary.

2Bt1—31 to 36 inches; dark brown (7.5YR 4/4) very gravelly sandy loam; weak medium subangular blocky structure; friable; many fine roots; clay coatings on sand grains; about 40 percent gravel; neutral; abrupt wavy boundary.

2Bt2—36 to 39 inches; dark brown (7.5YR 4/4) very gravelly sandy clay loam; moderate fine subangular blocky structure; friable; many fine roots; clay bridges between sand grains; about 40 percent gravel; neutral; abrupt wavy boundary.

2C—39 to 60 inches; light yellowish brown (10YR 6/4), stratified very gravelly sand and sand; single grain; loose; about 40 percent gravel; strong effervescence; slightly alkaline.

The thickness of the solum and the depth to free carbonates range from 25 to 40 inches. The content of gravel ranges from 3 to 10 percent in the A, E, and Bs horizons and from 35 to 55 percent in the 2Bt and 2C horizons. The content of cobbles ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2.

The E horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3.

The Bs horizon has hue of 5YR, 7.5YR, or 10YR and value and chroma of 4 to 6. It is loamy sand or sand.

The 2Bt horizon has hue of 7.5YR and value and chroma of 4 to 6. It is very gravelly sandy loam, very gravelly sandy clay loam, or very gravelly loam.

The 2C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is stratified very gravelly sand, gravelly sand, coarse sand, gravelly coarse sand, and sand.

Manistee Series

The Manistee series consists of moderately well drained and well drained soils on lake plains and outwash plains. These soils formed in sandy lacustrine and outwash materials underlain by clayey lacustrine deposits. Permeability is rapid in the sandy part and very slow in the clayey part. Slopes range from 0 to 45 percent.

Typical pedon of Manistee loamy sand, moderately wet, 0 to 6 percent slopes (fig. 22), 1,500 feet north and 1,600 feet west of the southeast corner of sec. 20, T. 26 N., R. 8 E.

A—0 to 4 inches; black (N 2/0) loamy sand, dark gray (N 4/0) dry; weak medium granular structure; very friable; common coarse and many fine roots; about 1 percent gravel; moderately acid; abrupt smooth boundary.

E—4 to 6 inches; pinkish gray (7.5YR 6/2) loamy sand, pinkish white (7.5YR 8/2) dry; moderate medium subangular blocky structure; friable; common medium and fine roots; about 1 percent gravel; moderately acid; abrupt irregular boundary.

Bs1—6 to 17 inches; strong brown (7.5YR 4/6) loamy sand; weak coarse subangular blocky structure; friable; few medium and common fine roots; about 1 percent gravel; slightly acid; clear smooth boundary.

Bs2—17 to 24 inches; strong brown (7.5YR 5/6) loamy sand; single grain; loose; few fine roots; about 1 percent gravel; neutral; abrupt smooth boundary.

2B/E—24 to 27 inches; about 70 percent reddish brown (5YR 5/3) clay (Bt); surrounded by pinkish gray (7.5YR 6/2) sandy loam, pinkish gray (7.5YR 7/2) dry (E); common fine prominent yellowish red (5YR 4/6) mottles; strong coarse angular blocky structure; firm; few fine roots; many very fine vesicular pores; many continuous faint reddish brown (5YR 4/3) clay films on faces of peds; about 1 percent gravel; neutral; abrupt smooth boundary.

2Bt1—27 to 32 inches; reddish brown (5YR 4/4) clay; common fine distinct yellowish red (5YR 4/6) mottles; strong coarse angular blocky structure; firm; many fine roots between peds; many very fine vesicular pores; many continuous faint reddish brown (5YR 4/3) clay films on faces of peds; about 1 percent gravel; slightly alkaline; abrupt wavy boundary.

2Bt2—32 to 50 inches; reddish brown (5YR 5/3) clay; strong coarse angular blocky structure; firm; many fine roots between peds; many very fine vesicular pores; many continuous faint reddish brown (5YR 4/4) clay films on faces of peds; about 1 percent gravel; strong effervescence; slightly alkaline; clear wavy boundary.

2C—50 to 60 inches; reddish brown (5YR 5/3) clay; massive; firm; about 1 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 50 inches. The content of gravel ranges from 0 to 5 percent in the sandy material.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3.

The E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. It is loamy sand or sand.

The E part of the 2B/E horizon has hue of 5YR, 7.5YR, or 10YR, value of 6, and chroma of 2 or 3. It is sandy loam or loamy sand.

The Bt part of the 2B/E horizon and the 2Bt horizon have hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. They are silty clay or clay.

The 2C horizon has hue of 5YR, 7.5YR, or 10YR, value of 5 or 6, and chroma of 3 or 4. It is clay or silty clay.

Markey Series

The Markey series consists of very poorly drained soils in depressions on lake plains. These soils formed in 16 to 50 inches of organic material underlain by sandy lacustrine deposits. Permeability is moderately slow to moderately rapid in the organic part and rapid in the sandy part. Slopes are 0 to 1 percent.

Typical pedon of Markey muck, 1,180 feet north and 1,350 feet west of the southeast corner of sec. 14, T. 28 N., R. 9 E.

Oa1—0 to 4 inches; muck, black (N 2/0) broken face, black (10YR 2/1) rubbed; about 45 percent fiber, 12 percent rubbed; weak thick platy structure; friable; primarily herbaceous fibers; many fine roots; slightly acid; clear smooth boundary.

Oa2—4 to 16 inches; muck, very dark brown (10YR 2/2) broken face, black (10YR 2/1) rubbed; about 45 percent fiber, 12 percent rubbed; weak thick platy structure; friable; primarily herbaceous fibers; few fine roots; neutral; clear smooth boundary.

Oa3—16 to 28 inches; muck, very dark brown (10YR 2/2) broken face, very dark brown (10YR 2/2) rubbed; about 30 percent fiber, less than 5 percent rubbed; weak thick platy structure; friable; primarily herbaceous fibers; neutral; gradual smooth boundary.

Cg—28 to 60 inches; grayish brown (10YR 5/2) sand; single grain; loose; neutral.

The depth to the sandy mineral layers ranges from 16 to 50 inches.

The Oa horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. Broken face, rubbed, and pressed colors are similar but may vary one unit in value, chroma, or both.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 1 to 3.

McGinn Series

The McGinn series consists of well drained, moderately permeable soils on ground moraines. These soils formed in sandy and loamy glacial till. Slopes range from 0 to 50 percent.

Typical pedon of McGinn loamy sand, 6 to 12 percent slopes (fig. 23), 150 feet south and 1,980 feet west of the northeast corner of sec. 23, T. 28 N., R. 6 E.

Oi—0 to 1 inch; black (5YR 2.5/1), partially decomposed forest litter; strongly acid; abrupt smooth boundary.

A—1 to 2 inches; black (N 2/0) loamy sand, very dark gray (N 3/0) dry; weak medium granular structure; friable; many fine roots; about 3 percent gravel and 1 percent cobbles; very strongly acid; abrupt broken boundary.

E—2 to 4 inches; light brownish gray (10YR 6/2) loamy sand, light gray (10YR 7/2) dry; weak fine subangular blocky structure; friable; common fine roots; about 3 percent gravel and 1 percent cobbles; very strongly acid; abrupt broken boundary.

Bw1—4 to 6 inches; strong brown (7.5YR 4/6) loamy sand; weak medium subangular blocky structure; friable; many fine and few medium roots; about 3 percent gravel and 1 percent cobbles; strongly acid; clear wavy boundary.

Bw2—6 to 16 inches; dark yellowish brown (10YR 4/4) loamy sand; moderate coarse subangular blocky structure; friable, about 10 percent of matrix is slightly brittle; common medium roots; about 3 percent gravel and 1 percent cobbles; strongly acid; abrupt wavy boundary.

E′—16 to 18 inches; grayish brown (10YR 5/2) loamy sand; weak thick platy structure; slightly brittle;

about 3 percent gravel and 1 percent cobbles; moderately acid; abrupt broken boundary.

E/B—18 to 21 inches; about 75 percent grayish brown (10YR 5/2) loamy sand, very pale brown (10YR 7/3) dry (E´); weak thick platy structure; surrounding peds of reddish brown (5YR 4/4) sandy loam (Bt); weak medium subangular blocky structure; slightly brittle; few medium roots; many very fine vesicular pores; few discontinuous faint reddish brown (5YR 4/4) clay films on faces of peds; about 3 percent gravel and 1 percent cobbles; moderately acid; abrupt irregular boundary.

2B/E—21 to 25 inches; about 80 percent reddish brown (5YR 4/4) sandy loam (Bt); many continuous distinct dark reddish brown (5YR 3/4) clay films on faces of peds; surrounded and coated by grayish brown (10YR 5/2) loamy sand, very pale brown (10YR 7/3) dry (E´); moderate medium subangular blocky structure; friable; few fine roots; many very fine vesicular pores; about 3 percent gravel and 1 percent cobbles; slightly acid; abrupt irregular boundary.

2Bt—25 to 35 inches; reddish brown (5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; common fine roots; many very fine vesicular pores; many distinct dark reddish brown (5YR 3/4) clay films on faces of peds; about 3 percent gravel and 1 percent cobbles; slightly acid; clear wavy boundary.

2C—35 to 80 inches; light reddish brown (5YR 6/3) sandy loam; massive with weakly expressed thick platiness inherited from the parent material; friable; few fine roots in vertical fractures; few continuous prominent white (10YR 8/2) lime or carbonate coatings in vertical fractures; about 5 percent gravel and 1 percent cobbles; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 24 to 40 inches. The thickness of the sandy upper part of the profile ranges from 14 to 20 inches. The content of gravel ranges from 2 to 10 percent throughout the profile, and the content of cobbles ranges from 0 to 5 percent.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1. The Ap horizon, if it occurs, has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6.

The E´ horizon and the E part of the E/B and B/E horizons have hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2.

The Bt part of the E/B and B/E horizons and the 2Bt horizon have hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 4. They are sandy loam or loam.

The 2C horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4.

Negwegon Series

The Negwegon series consists of well drained and moderately well drained, very slowly permeable soils on dissected lake plains. These soils formed in stratified loamy and clayey lacustrine deposits. Slopes range from 2 to 45 percent.

Typical pedon of Negwegon silt loam, moderately wet, 6 to 12 percent slopes, 1,280 feet south and 1,280 feet west of the northeast corner of sec. 10, T. 27 N., R. 9 E.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine angular blocky structure; friable; about 2 percent gravel; slightly acid; abrupt wavy boundary.

B/E—8 to 16 inches; about 80 percent reddish brown (5YR 4/4) silty clay loam (Bt); penetrated by tongues of brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry (E); few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure parting to moderate fine angular blocky; firm; common dark brown (10YR 4/3) worm channels and wormcasts; about 2 percent gravel; slightly acid; clear wavy boundary.

Bt1—16 to 24 inches; reddish brown (5YR 4/4) clay; thin strata of yellowish brown (10YR 5/4) silt loam throughout; moderate fine angular blocky structure; firm; common dark brown (10YR 4/3) worm channels and wormcasts; many faint reddish brown (5YR 4/4) clay films on faces of peds; about 1 percent gravel; slightly acid; abrupt wavy boundary.

Bt2—24 to 46 inches; reddish brown (5YR 4/4) silty clay; moderate medium prismatic structure; firm; common faint brown (7.5YR 5/4) clay films on faces of peds; about 1 percent gravel; neutral; abrupt wavy boundary.

C—46 to 60 inches; stratified brown (5YR 5/4) silty clay loam and yellowish brown (7.5YR 5/4) silt loam; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 25 to 50 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. It is silt loam or silty clay loam. Some pedons have an A horizon. This horizon is very dark grayish brown (10YR 3/2) silt loam. It is 1 to 3 inches thick.

The E part of the B/E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 or 3. Some pedons have an E horizon.

The Bt part of the B/E horizon and the Bt horizon have hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. They are silty clay loam, silty clay, or clay.

The C horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 to 6, and chroma of 3 or 4. It is stratified silty clay, silt loam, or silty clay loam.

Nester Series

The Nester series consists of well drained and moderately well drained, slowly permeable soils on till plains and moraines. These soils formed in loamy glacial till. Slopes range from 0 to 45 percent.

Typical pedon of Nester loam, moderately wet, 6 to 12 percent slopes, 150 feet north and 2,125 feet east of the southwest corner of sec. 17, T. 25 N., R. 6 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure; friable; many very fine roots; about 5 percent gravel and 1 percent cobbles; slightly acid; abrupt wavy boundary.

E/B—9 to 14 inches; about 70 percent brown (10YR 5/3) sandy loam, pale brown (10YR 6/3) dry (E); surrounding peds of reddish brown (5YR 4/4) clay loam (Bt); many fine prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common very fine roots; about 10 percent gravel and 1 percent cobbles; slightly acid; clear wavy boundary.

B/E—14 to 19 inches; about 85 percent reddish brown (5YR 4/4) clay loam (Bt); surrounded by brown (10YR 5/3) sandy loam, pale brown (10YR 6/3) dry (E); many medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common very fine roots; many very fine vesicular pores; about 10 percent gravel and 1 percent cobbles; slightly acid; abrupt wavy boundary.

Bt1—19 to 25 inches; reddish brown (5YR 4/4) clay loam; few fine distinct yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few very fine roots; many very fine vesicular pores; many continuous faint reddish brown (5YR 4/3) clay films on faces of peds; about 10 percent gravel and 1 percent cobbles; neutral; gradual wavy boundary.

Bt2—25 to 40 inches; reddish brown (5YR 5/4) clay loam; weak coarse subangular blocky structure; firm; few very fine roots between peds; many very fine vesicular pores; common discontinuous faint reddish brown (5YR 4/3) clay films on vertical faces of peds; about 10 percent gravel and 1 percent cobbles; slight effervescence; slightly alkaline; clear wavy boundary.

C—40 to 60 inches; light reddish brown (5YR 6/4) clay loam; massive with weakly expressed thick plates inherited from the parent material; firm; common patchy prominent white (10YR 8/1) calcium carbonate coatings on faces of plates; about 10 percent gravel and 1 percent cobbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 50 inches. The content of gravel ranges from 0 to 10 percent throughout the profile, and the content of cobbles ranges from 0 to 3 percent.

The Ap horizon has hue of 10YR, value of 3, and chroma of 1 or 2.

The E part of the E/B and B/E horizons has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 2 or 3. It is sandy loam or loam.

The Bt part of the E/B and B/E horizons and the Bt horizon have hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. They are clay loam, silty clay loam, or clay.

The C horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 4. It is clay loam or silty clay loam.

Richter Series

The Richter series consists of somewhat poorly drained, moderately permeable soils on lake plains and in glacial drainageways. These soils formed in stratified sandy and loamy lacustrine and glaciofluvial sediments. Slopes range from 0 to 3 percent.

Typical pedon of Richter loamy fine sand, 0 to 3 percent slopes, 30 feet south and 1,200 feet west of the northeast corner of sec. 10, T. 26 N., R. 8 E.

A—0 to 8 inches; black (10YR 2/1) loamy fine sand, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; very friable; many fine and common medium roots; strongly acid; abrupt wavy boundary.

E—8 to 12 inches; light gray (10YR 7/2) loamy sand, white (10YR 8/2) dry; weak medium subangular blocky structure; very friable; common fine roots; moderately acid; clear broken boundary.

Bs—12 to 18 inches; dark brown (7.5YR 4/4) loamy sand; many coarse distinct strong brown (7.5YR 4/6) and dark reddish brown (5YR 3/3) mottles; weak thick platy structure parting to weak fine subangular blocky; friable; common fine roots; common patchy distinct dark brown (10YR 4/3) organic coatings; moderately acid; abrupt wavy boundary.

B/E—18 to 26 inches; about 80 percent brown (7.5YR 5/4) sandy loam (Bt); surrounded by pale brown (10YR 6/3) loamy sand, very pale brown (10YR 7/3) dry (E); common medium distinct pinkish gray (7.5YR 6/2) and common medium distinct strong brown (7.5YR 5/8) mottles; moderate thick platy structure parting to moderate medium subangular blocky; friable; few fine roots; moderately acid; clear wavy boundary.

Bt—26 to 37 inches; brown (7.5YR 5/4) and reddish brown (5YR 5/4), stratified fine sandy loam and clay loam; common fine prominent greenish gray (5GY 5/1) and common medium prominent strong brown (7.5YR 5/8) mottles; weak thick platy structure parting to moderate fine angular blocky; friable; few fine roots; common discontinuous faint reddish brown (5YR 5/3) clay films on faces of peds; neutral; abrupt smooth boundary.

C—37 to 60 inches; pinkish gray (7.5YR 6/2) and reddish brown (5YR 5/3), stratified loamy sand and silt loam; few medium prominent greenish gray (5GY 6/1) and few medium prominent strong brown (7.5YR 5/8) mottles; massive; friable; about 5 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 22 to 40 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The E horizon has hue of 10YR or 7.5YR, value of 6 or 7, and chroma of 1 or 2. It is loamy sand or very fine sandy loam.

The Bs horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loamy sand or sandy loam.

The E part of the B/E horizon has hue of 10YR, value of 6 or 7, and chroma of 2 to 4. It is loamy sand, fine sandy loam, or very fine sandy loam.

The Bt part of the B/E horizon and the Bt horizon have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. They are stratified fine sandy loam to clay loam.

The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 or 3. It is stratified loamy sand to silt loam.

Rondeau Series

The Rondeau series consists of very poorly drained soils on lake plains. These soils formed in highly decomposed organic soil materials and in the underlying marl. Permeability is moderately slow to moderately rapid in the organic layers and slow or very slow in the marl layers. Slopes are 0 to 1 percent.

Typical pedon of Rondeau muck, 420 feet north and 550 feet west of the southeast corner of sec. 35, T. 25 N., R. 6 E.

Oa1—0 to 6 inches; muck, black (N 2/0) broken face and black (10YR 2/1) rubbed; about 60 percent fiber, 15 percent rubbed; weak medium subangular blocky structure; friable; common very fine and many fine roots; many fine continuous tubular pores; neutral; clear smooth boundary.

Oa2—6 to 19 inches; muck, dark reddish brown (5YR 2.5/2) broken face and black (10YR 2/1) rubbed; about 50 percent fiber, less than 10 percent rubbed; weak medium subangular blocky structure; friable; common fine and few medium roots; many very fine continuous tubular pores; neutral; abrupt smooth boundary.

Cg—19 to 60 inches; light gray (10YR 7/1) marl; friable; common fine and few medium roots; violent effervescence; moderately alkaline.

The depth to the marl layer ranges from 16 to 49 inches. The surface tier and the organic portion of the lower tiers are muck.

The Oa horizon has hue of 5YR or is neutral in hue. It has value of 2 or 2.5 and chroma of 0 to 2.

The Cg horizon has hue of 10YR, value of 7, and chroma of 1 or 2.

Springport Series

The Springport series consists of poorly drained, very slowly permeable soils on lake plains. These soils formed in stratified loamy and clayey lacustrine deposits. Slopes range from 0 to 2 percent.

Typical pedon of Springport clay loam, 1,000 feet north and 675 feet east of the southwest corner of sec. 18, T. 25 N., R. 9 E.

Ap—0 to 8 inches; very dark gray (10YR 3/1) clay loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure parting to moderate fine subangular blocky; friable; many fine and medium roots between peds; about 1 percent gravel; neutral; abrupt smooth boundary.

Bg—8 to 12 inches; grayish brown (2.5Y 5/2) clay;

many coarse prominent yellowish brown (10YR 5/6) and gray (10YR 6/1) mottles; moderate medium subangular blocky structure; firm; common fine and medium roots between peds; about 1 percent gravel; slight effervescence; slightly alkaline; clear wavy boundary.

Bt—12 to 27 inches; reddish brown (5YR 4/3) silty clay; many coarse prominent yellowish brown (10YR 5/6) and gray (10YR 6/1) mottles; very coarse prismatic structure parting to moderate medium subangular blocky; firm; common fine roots between peds; few prominent greenish gray (5GY 6/1) lime or carbonate coatings on vertical and horizontal faces of peds; few thin prominent very dark grayish brown (10YR 3/2) organic coatings on vertical faces of peds; few distinct greenish gray (5GY 5/1) clay films on faces of peds; about 1 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

C—27 to 60 inches; reddish brown (5YR 5/3) silty clay; common medium prominent strong brown (7.5YR 5/8) mottles; weak very thick platy fragments; firm; common patchy prominent greenish gray (5GY 6/1) lime or carbonate coatings throughout; about 1 percent gravel; violent effervescence; moderately alkaline.

The depth to carbonates ranges from 7 to 15 inches. The content of gravel is 0 to 1 percent.

The Ap horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is dominantly clay loam, but the range includes silt loam.

The Bg horizon has hue of 5Y, 2.5Y, or 10YR, value of 5 or 6, and chroma of 1 or 2. It is clay or silty clay.

The Bt horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is silty clay or silty clay loam.

The C horizon has hue of 5YR, value of 4 to 6, and chroma of 2 to 4. It is silty clay or silty clay loam or is stratified with these textures.

Sprinkler Series

The Sprinkler series consists of somewhat poorly drained, moderately slowly permeable soils on ground moraines. These soils formed in loamy glacial till. Slopes range from 0 to 3 percent.

Typical pedon of Sprinkler sandy loam, 0 to 3 percent slopes, 2,565 feet south and 2,565 feet west of the northeast corner of sec. 14, T. 25 N., R. 6 E.

A—0 to 5 inches; very dark gray (10YR 3/1) sandy loam, gray (10YR 5/1) dry; weak medium subangular blocky structure; friable; many fine and medium roots; about 2 percent gravel; strongly acid; abrupt smooth boundary.

E—5 to 13 inches; brown (10YR 5/3) sandy loam, very pale brown (10YR 7/3) dry; common fine distinct yellowish brown (10YR 5/6) and common fine prominent strong brown (7.5YR 4/6) mottles; moderate medium subangular blocky structure; firm; common fine roots in worm channels; common fine vesicular pores; about 2 percent gravel; strongly acid; clear wavy boundary.

(E/B)x—13 to 23 inches; about 70 percent brown (10YR 5/3) sandy loam, very pale brown (10YR 7/3) dry (E); occurring as tongues surrounding peds of brown (7.5YR 5/4) loam (Bt); common fine prominent strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) mottles; weak very thick platy structure; firm; slightly brittle; few fine roots between peds; many fine vesicular pores; about 2 percent gravel; strongly acid; clear irregular boundary.

(B/E)x—23 to 28 inches; about 70 percent brown (7.5YR 5/4) loam (Bt); surrounded by brown (10YR 5/3) sandy loam, very pale brown (10YR 7/3) dry (E); common fine prominent yellowish brown (10YR 5/6) and prominent grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure parting to weak very thick platy; firm; slightly brittle; few fine roots between peds; many fine vesicular pores; about 2 percent gravel; strongly acid; clear wavy boundary.

Bt1—28 to 35 inches; dark brown (7.5YR 4/4) loam; common medium prominent yellowish brown (10YR 5/6) mottles on faces of peds and few fine prominent grayish brown (10YR 5/2) mottles in clay films and near roots; weak very thick platy structure; firm; few fine roots between peds; many fine vesicular pores; common faint brown (7.5YR 5/4) clay films more than 1 millimeter thick in vertical cracks between peds; about 5 percent gravel; strongly acid; clear wavy boundary.

Bt2—35 to 44 inches; brown (7.5YR 5/4) loam; few fine prominent gray (N 6/0) and common fine distinct strong brown (7.5YR 5/6) mottles; weak very thick platy structure; firm; few patchy faint brown (7.5YR 5/4) clay films on faces of peds; about 5 percent gravel; slight effervescence; moderately alkaline; clear wavy boundary.

C—44 to 60 inches; brown (7.5YR 5/3) loam; common fine distinct strong brown (7.5YR 5/6) mottles; massive; friable; about 5 percent gravel; slight effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 50 inches. The content of gravel ranges from 1 to 5 percent throughout the profile, and the content of cobbles ranges from 0 to 3 percent.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 3 and chroma of 0 or 1.

The E horizon has hue of 2.5Y or 10YR, value of 5, and chroma of 2 or 3.

The E part of the (E/B)x and (B/E)x horizons has hue of 5YR, 7.5YR, or 10YR or is neutral in hue. It has value of 5 or 6 and chroma of 0 to 3. The (E/B)x and (B/E)x horizons are slightly brittle but do not qualify as fragipans.

The Bt part of the (E/B)x and (B/E)x horizons has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam or clay loam.

The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam or clay loam.

The C horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4. It is loam or clay loam.

Tawas Series

The Tawas series consists of very poorly drained soils on lake terraces. These soils formed in 16 to 50 inches of organic material underlain by sandy lacustrine deposits. Permeability is moderately slow to moderately rapid in the organic part and rapid in the sandy part. Slopes range from 0 to 2 percent.

Typical pedon of Tawas muck, in an area of Tawas-Au Gres complex, 0 to 4 percent slopes, 2,270 feet south and 820 feet west of the northeast corner of sec. 34, T. 25 N., R. 9 E.

Oa1—0 to 5 inches; muck, black (N 2/0) broken face and rubbed; about 80 percent fiber, less than 15 percent rubbed; weak thick platy structure; friable; primarily woody fibers; moderately acid; clear smooth boundary.

Oa2—5 to 17 inches; muck, black (N 2/0) broken face and rubbed; about 40 percent fiber, 10 percent rubbed; weak thick platy structure; friable; primarily woody fibers; about 30 percent chunks of wood; neutral; abrupt smooth boundary.

C1—17 to 18 inches; brown (10YR 5/3) sand; single grain; nonsticky; slightly alkaline; clear smooth boundary.

C2—18 to 60 inches; dark brown (10YR 4/3) sand; single grain; nonsticky; slightly alkaline.

The depth to the sandy mineral layers ranges from 16 to 50 inches. The content of gravel in the mineral layers ranges from 0 to 5 percent.

The organic material has hue of 5YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. Broken face, rubbed, and pressed colors are similar but may vary one unit in value, chroma, or both.

The C horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 4 or 5 and chroma of 0 to 3.

Tonkey Series

The Tonkey series consists of poorly drained, moderately permeable soils on lake plains, on outwash plains, and in glacial drainageways. These soils formed in stratified loamy and silty lacustrine and glaciofluvial deposits. Slopes range from 0 to 2 percent.

The Tonkey soils in Alcona County are taxadjuncts because they have higher chroma and a slightly higher silt content in the subsoil than are defined as the range for the series. These differences do not significantly affect use and management.

Typical pedon of Tonkey silt loam, 1,690 feet south and 1,010 feet east of the northwest corner of sec. 10, T. 26 N., R. 9 E.

A—0 to 6 inches; black (10YR 2/1) silt loam, grayish brown (10YR 5/2) dry; common fine faint dark gray (10YR 4/1) mottles; weak fine granular structure; friable; many fine and common medium roots; slightly acid; abrupt wavy boundary.

Bg—6 to 12 inches; pinkish gray (7.5YR 6/2) very fine sandy loam; common fine prominent greenish gray (5GY 6/1) and distinct strong brown (7.5YR 5/6) mottles; weak fine angular blocky structure; friable; common fine roots; common continuous prominent black (10YR 2/1) organic coatings on faces of peds; neutral; abrupt smooth boundary.

Bw—12 to 26 inches; brown (10YR 5/3), stratified very fine sandy loam and silt loam; many medium distinct yellowish brown (10YR 5/6) and fine faint grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; friable; slightly alkaline; clear smooth boundary.

Cg—26 to 60 inches; brown (7.5YR 5/2), stratified silt loam, very fine sandy loam, and silt; many medium prominent strong brown (7.5YR 5/8) and common medium faint pinkish gray (7.5YR 6/2) mottles; massive; friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 25 to 35 inches. The content of gravel ranges from 0 to 2 percent in the solum.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1.

The Bg and Bw horizons have hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 to 3. They are stratified very fine sandy loam to silt loam.

The Cg horizon has hue of 7.5YR, value of 5 or 6, and chroma of 2.

Typic Haplaquods

These soils are classified as mixed, frigid Typic Haplaquods. They are very poorly drained, rapidly permeable soils on lake plains and outwash plains. They formed in sandy lacustrine or outwash material. Slopes range from 0 to 2 percent.

An organic surface layer, 4 to 7 inches thick, is typically on the surface. It is dominantly muck or mucky peat. It has hue of 5YR to 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2.

The E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 or 2. It is sand, loamy sand, or fine sand.

The Bhs horizon has hue of 5YR or 7.5YR and value and chroma of 2 or 3. It is sand, loamy sand, or fine sandy loam.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 4 to 6.

The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 4. It is sand, loamy sand, or fine sand.

Typic Udipsamments

These soils are classified as mixed, frigid Typic Udipsamments. They are moderately well drained and excessively drained, rapidly permeable soils on outwash plains, stream terraces, and overwashed moraines. They formed in sandy glaciofluvial material. Slopes range from 0 to 50 percent.

Reference pedon of Typic Udipsamments, nearly level and undulating, 2,620 feet north and 20 feet east of the southwest corner of sec. 4, T. 26 N., R. 5 E.

Oi—1 inch to 0; undecomposed hardwood and coniferous leaf litter.

A—0 to 2 inches; very dark gray (10YR 3/1) sand, dark grayish brown (10YR 4/2) dry; weak medium granular structure; very friable; many very fine and fine roots; strongly acid; abrupt wavy boundary.

E—2 to 4 inches; light brownish gray (10YR 6/2) sand, light gray (10YR 7/2) dry; weak medium subangular blocky structure; very friable; strongly acid; abrupt wavy boundary.

Bw—4 to 22 inches; dark yellowish brown (10YR 4/4) sand; weak coarse subangular blocky structure; very friable; strongly acid; clear wavy boundary.

BC—22 to 40 inches; yellowish brown (10YR 5/6) sand; single grain; loose; strongly acid; gradual wavy boundary.

C—40 to 180 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; strongly acid.

The thickness of the solum ranges from 20 to 40 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3.

The E horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. It is sand or loamy sand. Some pedons do not have an E horizon.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is sand or loamy sand.

The C horizon has hue of 10YR or 7.5YR, value of 6 or 7, and chroma of 4 to 6. It is sand or coarse sand. Loamy sand, coarse loamy sand, and gravelly loamy sand may occur below a depth of 60 inches. Banded substratum phases have thin bands of loamy sand or sandy loam below a depth of 60 inches. Loamy substratum phases have sandy loam to sandy clay loam below a depth of 40 inches. A seasonal high water table is below a depth of 3 feet in some pedons.

Udipsamments

These soils are classified as mixed, frigid Udipsamments. They are excessively drained, rapidly permeable soils on outwash plains. They formed in sands. Slopes range from 0 to 40 percent.

These soils are on the bottoms and sides of borrow pits or in areas of sandy filled land. They have hue of 10YR, value of 5 to 7, and chroma of 3 or 4. They are sand.

Udorthents

These soils are classified as mixed, frigid Udorthents. They are well drained, moderately permeable or moderately slowly permeable soils on moraines. They formed in loamy glacial till. Slopes range from 0 to 12 percent.

These soils are on the bottoms and sides of borrow pits or in areas of loamy filled land. They have hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 3 or 4. Textures include sandy loam, loam, and clay loam.

Wakeley Series

The Wakeley series consists of very poorly drained soils on lake terraces. These soils formed in sandy lacustrine materials underlain by clayey lacustrine deposits. Permeability is rapid in the sandy part and very slow in the clayey part. Slopes range from 0 to 2 percent.

Typical pedon of Wakeley mucky sand, in an area of Au Gres, clayey substratum-Wakeley complex, 0 to 4 percent slopes, 50 feet south and 2,550 feet west of the northeast corner of sec. 20, T. 25 N., R. 8 E.

A—0 to 6 inches; black (N 2/0) mucky sand, very dark gray (N 3/0) dry; common fine distinct dark gray (N 4/0) mottles; weak medium subangular blocky structure; friable; many fine roots; moderately acid; abrupt smooth boundary.

Cg1—6 to 12 inches; gray (10YR 5/1) sand; single grain; nonsticky; common fine roots; common discontinuous faint dark gray (10YR 4/1) organic coatings throughout; slightly acid; clear smooth boundary.

Cg2—12 to 24 inches; grayish brown (10YR 5/2) sand; many medium prominent weak red (2.5YR 5/2) mottles; single grain; nonsticky; neutral; clear smooth boundary.

Cg3—24 to 29 inches; grayish brown (10YR 5/2), stratified sand and loamy sand; common medium distinct yellowish brown (10YR 5/6) and common medium prominent greenish gray (5GY 5/1) mottles; single grain; nonsticky; neutral; abrupt smooth boundary.

2Cg4—29 to 34 inches; pinkish gray (7.5YR 6/2) clay; many medium prominent yellowish brown (10YR 5/6) and many fine prominent greenish gray (5G 6/1) mottles; massive; firm; few fine roots; slight effervescence; moderately alkaline; clear wavy boundary.

2Cg5—34 to 60 inches; pinkish gray (7.5YR 6/2), stratified clay and silty clay; many coarse prominent yellowish brown (10YR 5/6) and many medium prominent greenish gray (5G 6/1) mottles; massive; firm; strong effervescence; moderately alkaline.

The thickness of the upper sandy layers ranges from 20 to 40 inches. The content of gravel ranges from 0 to 3 percent throughout the profile.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1.

The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 1 to 3. It is sand or loamy sand.

The 2C horizon has hue of 7.5YR or 5YR, value of 5 or 6, and chroma of 1 to 3. It is clay, silty clay loam, or silty clay.

Waucedah Series

The Waucedah series consists of very poorly drained soils on flood plains. These soils formed in stratified sandy to silty alluvium over clayey lacustrine deposits. Permeability is moderate in the alluvium and very slow in the clayey material. Slopes are 0 to 1 percent.

Typical pedon of Waucedah muck, frequently flooded, 140 feet south and 2,210 feet west of the northeast corner of sec. 22, T. 27 N., R. 9 E.

Oa—0 to 9 inches; muck, very dark gray (10YR 3/1) broken face and black (10YR 2/1) rubbed; about 30 percent fiber, 5 percent rubbed; weak fine granular structure; friable; many fine roots; herbaceous and woody fiber; about 15 percent mineral material; slightly acid; abrupt smooth boundary.

A—9 to 13 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; common fine prominent yellowish red (5YR 4/6) and dark reddish brown (5YR 3/4) mottles; moderate medium subangular blocky structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

Cg1—13 to 18 inches; dark gray (10YR 4/1) silt loam; common fine prominent strong brown (7.5YR 4/6) mottles; weak medium platy structure; friable; neutral; abrupt smooth boundary.

Cg2—18 to 55 inches; dark grayish brown (10YR 4/2) and black (10YR 2/1) loamy sand and sandy loam; massive; friable; neutral; abrupt smooth boundary.

2Cg3—55 to 60 inches; brown (7.5YR 5/2) silty clay; massive; firm; strong effervescence; moderately alkaline.

The depth to carbonates ranges from 40 to 60 inches.

The Oa horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1.

The C horizon has hue of 7.5YR or 10YR, value of 2 to 5, and chroma of 1 to 3. It is stratified loamy sand to silt loam. Silty clay is below a depth of 40 inches.

Wheatley Series

The Wheatley series consists of very poorly drained soils on lake terraces and in glacial drainageways. These soils formed in sandy and gravelly lacustrine and glaciofluvial deposits. Permeability is rapid in the upper part and very rapid in the lower part. Slopes are 0 to 1 percent.

The Wheatley soils in Alcona County are taxadjuncts because they have higher chroma above a depth of 20 inches and do not have a dark mineral surface layer. These differences do not significantly affect use and management.

Typical pedon of Wheatley muck, 1,210 feet south and 900 feet east of the northwest corner of sec. 15, T. 25 N., R. 9 E.

Oa—0 to 5 inches; black (N 2/0) muck, black (N 2/0) dry; weak fine granular structure; friable; about 20 percent light gray (N 7/0) sand; many fine roots; slightly acid; abrupt smooth boundary.

Cg—5 to 9 inches; gray (5Y 5/1) sand; common medium prominent very dark gray (N 3/0) mottles; single grain; loose; about 10 percent gravel; neutral; abrupt smooth boundary.

C—9 to 34 inches; brown (10YR 5/3) sand; few fine prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; friable; about 10 percent gravel; neutral; abrupt smooth boundary.

2Cg—34 to 60 inches; greenish gray (5GY 5/1) gravelly sand; single grain; nonsticky; about 30 percent gravel; violent effervescence; moderately alkaline.

The depth to carbonates ranges from 20 to 40 inches. The content of gravel ranges from 5 to 10 percent in the upper part and from 15 to 35 percent in the lower part.

The Oa horizon has hue of 10YR or is neutral in hue. It has value of 1 or 2 and chroma of 0 to 2.

The C horizons have hue of 5Y to 10YR, value of 4 to 6, and chroma of 1 to 3. They are sand or loamy sand.

The 2Cg horizon has hue of 5GY to 10YR or is neutral in hue. It has value of 4 to 6 and chroma of 0 or 1. It is gravelly sand or gravelly loamy sand.

Zimmerman Series

The Zimmerman series consists of excessively drained, rapidly permeable soils on lake terraces, dissected lake plains, and deltas. These soils formed in sandy lacustrine deposits. Slopes range from 0 to 60 percent.

Typical pedon of Zimmerman loamy fine sand (fig. 24), in an area of Zimmerman-Alcona, moderately wet, complex, 6 to 18 percent slopes, 500 feet north and 170 feet west of the southeast corner of sec. 9, T. 25 N., R. 9 E.

A—0 to 2 inches; black (N 2/0) loamy fine sand, dark gray (N 4/0) dry; weak medium granular structure; friable; many fine and common medium roots; moderately acid; abrupt smooth boundary.

E—2 to 4 inches; grayish brown (10YR 5/2) loamy fine sand, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; very friable; many fine and common medium roots; moderately acid; abrupt smooth boundary.

Bw1—4 to 7 inches; strong brown (7.5YR 4/6) loamy fine sand; weak medium subangular blocky structure; very friable; many fine and common medium roots; about 1 percent gravel; moderately acid; clear wavy boundary.

Bw2—7 to 24 inches; yellowish brown (10YR 5/6) loamy fine sand; weak medium subangular blocky structure; very friable; few fine roots; slightly acid; clear wavy boundary.

E and Bt—24 to 80 inches; yellowish brown (10YR 5/4) fine sand, very pale brown (10YR 7/4) dry (E); weak medium platy structure; very friable; lamellae of strong brown (7.5YR 4/6) loamy fine sand (Bt) 1/4 inch in thickness with a total accumulation of 2 1/2 inches; neutral.

The thickness of the solum and the depth to free carbonates range from 60 to more than 80 inches. The content of gravel ranges from 0 to 3 percent throughout the profile.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2.

The E horizon and the E part of the E and Bt horizon have hue of 10YR, value of 5 to 7, and chroma of 2 to 4. They are fine sand or loamy fine sand.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6.

The Bt part of the E and Bt horizon consists of one or more thin lamellae that begin at depths of 24 to 60 inches and range from 1/2 inch to less than 6 inches in combined thickness. The lamellae have hue of 7.5YR, value of 4 or 5, and chroma of 3 to 6. They are loamy fine sand or fine sandy loam.

Formation of the Soils

This section describes the factors of soil formation and relates them to the soils in the survey area. It also describes the processes of soil formation.

Factors of Soil Formation

Soil forms through the interaction of five major factors. These are the physical, chemical, and mineral composition of the parent material; the climate under which the soil material has accumulated and has existed since accumulation; the plant and animal life on and in the soil; the relief, or topography; and the length of time that the processes of soil formation have acted on the parent material (Jenny, 1941).

Climate and plant and animal life are the active forces of soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and plant and animal life are conditioned by relief. The nature of the parent material affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time changes the parent material into a soil. Generally, a long time is required for the formation of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made about the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. The parent material of the soils in Alcona County was deposited by glaciers or by meltwater from the glaciers. Some of this material was subsequently reworked by water and wind. The glaciers covered the county about 12,000 years ago. Parent material determines the chemical and mineralogical composition of the soil. Although the soils in the county have parent material of common glacial origin, the properties of the parent material vary greatly, sometimes within a small area, depending on how the material was deposited. The dominant parent materials in Alcona County were deposited as glacial till, outwash material, lake sediment, alluvium, or organic material.

Glacial till is material that was deposited directly by glaciers with a minimum of water action. It consists of a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Alcona County generally is calcareous sandy loam and loam. Hoist soils formed in glacial till. Typically, they are loamy and have moderately developed structure.

Outwash material was deposited by running water from melting glaciers. The size of the particles that make up outwash material depends on the speed of the water that carried them. When the water slows down, the coarser particles are deposited. The finer particles, such as very fine sand, silt, and clay, are carried by slowly moving water. Outwash deposits generally consist of layers of particles of similar size, such as sand, coarse sand, and gravel. Mancelona soils are examples of soils that formed in outwash material.

Lake sediment is material that settled from still or slowly moving, deep lake water and from shallow, high-energy water near shorelines. Lake sediments are well sorted, and the size of the particles depends on the speed of the water that suspends them. Au Gres soils are examples of sandy soils that formed in parent material deposited in sandbars on a shallow lake bottom. Springport soils are examples of fine textured soils that formed in parent material deposited on a deep lake bottom.

Alluvial material has been deposited by floodwater of present streams in recent time. The texture of this material depends on the speed of the water that deposited the material. Ausable soils are alluvial soils.

Organic material is made up of plant remains. After the glaciers receded from the area, water was left standing in depressions on outwash plains, flood plains, and till plains. Grasses and sedges that grew around the edge of these depressions died. Because of the wetness, when the plants died their remains did not decompose but accumulated around the edge of the depressions. Later, water-tolerant trees grew in these areas. As these trees died, their residue became part of the organic accumulation. Consequently, the depressions were eventually filled with organic material and developed into areas of muck. Lupton soils are examples of soils that formed in organic material.

Plant and Animal life

Green plants have been the principal organism influencing the soils in Alcona County. Bacteria, fungi, earthworms, and humans also have been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic matter on and in the soil depends on the kinds of plants that grew on the soil. The residue of these plants accumulates on the surface of the soil. It decays and eventually becomes organic matter. Plant roots provide channels for the downward movement of water through the soil and add organic matter to the soil as they decay. Bacteria in the soil help to break down the organic matter into a form that can be used by plants.

The vegetation in Alcona County was a mixture of coniferous and deciduous forest. Differences in natural soil drainage and changes in parent material affect the composition of forests.

In general, the well drained upland soils, such as McGinn and Glennie soils, were covered with red oak and white pine. Grayling soils were covered with northern pin oak and jack pine. The very poorly drained soils were covered with cedar, black spruce, and aspen. Kinross and Wakeley soils, which formed under wet conditions, contain a considerable amount of organic matter.

Climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil and determines the amount of water available for the weathering of minerals and the transporting of soil materials. Through its influence on soil temperature, climate determines the rate of chemical reactions in the soil. These climatic influences generally affect areas larger than a county.

The climate in Alcona County is cool and humid. Presumably, it is similar to the climate under which the soils formed. The soils in Alcona County differ from soils that formed in a dry, warm climate or from those that formed in a moist, hot climate. Climate is uniform throughout the county, but its effect is modified locally by the proximity to Lake Huron. The minor differences in the soils in Alcona County are partially the result of climatic differences.

Relief

Relief, or topography, has had a marked influence on the formation of the soils in Alcona County through its influence on natural drainage, erosion, plant cover, and soil temperature. In this county, slopes range from 0 to 60 percent. Natural drainage ranges from excessively drained on hilltops to very poorly drained in depressions.

Relief influences the formation of soils by affecting runoff and drainage. Drainage in turn, through its effect on aeration of the soil, determines the color of the soil. Runoff is most rapid on the steeper slopes, but in low areas, water can be temporarily ponded.

Water and air move freely through well drained soils but slowly through very poorly drained soils. In soils that are well aerated, the iron and aluminum compounds that give most soils their color are brightly colored and are oxidized. Poorly aerated soils are dull gray and mottled. Manistee soils are examples of well drained, well aerated soils; Wakeley soils are examples of poorly drained, poorly aerated soils. Both soils formed in similar parent material.

Time

Generally, a long time is required for the development of distinct horizons in a soil. The differences in the length of time that the parent material has been in place are commonly reflected in the degree of development of the soil profile. Some soils form rapidly; others form slowly.

The soils of Alcona County range from young to mature. The glacial deposits in which many of the soils formed have been exposed to soil-forming factors long enough for distinct horizons to develop. Some soils forming in recent alluvial sediment have not been in place long enough for the development of distinct horizons. Ausable soils, which formed in alluvial material, are young soils. Glennie soils show the effects of leaching of lime from the soil, which has taken place over a long period of time.

Processes of Soil Formation

The process responsible for the development of the soil horizons from unconsolidated parent material is referred to as soil genesis. Soil morphology describes the physical, chemical, and biological properties of these horizons.

Several processes were involved in the development of soil horizons in Alcona County. They include the accumulation of organic matter; the leaching of lime (calcium carbonate) and other bases; the reduction and transfer of iron; and the formation and translocation of clay minerals. In most soils, more than one of these processes have been active in the development of horizons.

Organic matter accumulates at the surface to form an A horizon. If the soil is plowed, the A horizon is mixed into a plow layer, or Ap horizon. In the soils of Alcona County, the content of organic matter in the surface layer ranges from high to low. For example, Leafriver soils have a high content of organic matter in the surface layer; Grayling soils have a low content of organic matter.

Leaching of carbonates and other bases has occurred in most of the soils. Soil scientists generally agree that leaching of bases in soils precedes the translocation of clay minerals. Many of the soils in Alcona County are moderately or strongly leached. McGinn soils are leached of carbonates to a depth of 20 to 40 inches. Grayling soils are leached to a depth of more than 60 inches. This difference in the depth of leaching is a result of time, relief, and parent material.

The reduction and transfer of iron, a process called gleying, is evident in the somewhat poorly drained, poorly drained, and very poorly drained soils. The gray or dull color in the subsoil indicates the reduction and loss of iron. Wakeley soils are examples of soils in which the gleying processes are evident.

Translocation of clay minerals has contributed to horizon development. An eluviated, or leached, E horizon above an illuviated B horizon has a lower content of clay than the B horizon and typically is lighter in color. The B horizon typically has an accumulation of clay and clay films in pores and on the faces of peds. The soils displaying this translocation of clay were probably leached of carbonates and soluble salts to a considerable extent before the translocation of clay took place. Leaching of bases and translocation of clays are among the more important processes in horizon differentiation. Negwegon soils have translocated clay in the form of clay films accumulated in the B horizon.

In some soils, iron, aluminum, and humus have moved from the surface layer to the B horizon. The B horizon in such soils commonly is dark brown or dark reddish brown. Au Gres and Kinross soils are examples of soils in which translocated iron, aluminum, and humus have affected the B horizon.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bar. A ridgelike accumulation of sand, gravel, or other alluvial material that has formed in the channel, along the banks, or at the mouth of a stream where a decrease in velocity induces deposition.

Basal till. Compact glacial till deposited beneath the ice.

Beach ridge. A low, essentially continuous mound of beach or beach-and-dune material heaped up by the action of waves and currents on the backshore of a beach, beyond the present limit of storm waves or the reach of ordinary tides, and occurring singly or as one of a series of approximately parallel deposits. The ridges are roughly parallel to the shoreline and represent successive positions of an advancing shoreline.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A general term for a small saucer-, cup-, or trough-shaped hollow or depression formed by wind erosion, or a pre-existing dune or other sand deposit, especially in an area of shifting sand or loose soil or where protective vegetation is disturbed or destroyed; the adjoining accumulation of sand derived from the depression, where recognizable, is commonly included.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Channel. The hollow bed where a natural body of surface water flows or may flow. The deepest or central part of the bed of a stream, containing the main current and occupied more or less continuously by water.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles 2 millimeters to 38 centimeters (15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Delta. A body of alluvium, nearly flat and fan shaped, deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depression. Any relatively sunken part of the earth's surface; especially a low-lying area surrounded by higher ground. A closed depression has no natural outlet for surface drainage, for example, a karstic sinkhole.

Disintegration moraine. A drift topography characterized by chaotic mounds and pits, generally randomly oriented, which formed in superglacial drift by collapse and flow as the underlying stagnant ice melted. Slopes may be steep and unstable, and used and unused stream courses and lake depressions are interspersed with the morainic ridges. Consequently, there will be rapid or abrupt changes between materials of differing lithology.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. A general term for a channel or course along which water moves in draining an area.

Drift. A general term applied to all rock material (clay, silt, sand, gravel, boulders) transported by a glacier and deposited directly by or from the ice or by running water emanating from a glacier. Drift includes unstratified material (till) that forms moraines and stratified glaciofluvial deposits that form outwash plains, eskers, kames, varves, and glaciolacustrine sediments.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached. Drumlins are products of streamline (laminar) flow of glaciers, which molded the subglacial floor through a combination of erosion and deposition.

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.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and produced by erosion or faulting.

Esker (geology). A long, narrow, sinuous, steep-sided ridge of irregularly stratified sand and gravel that was deposited by a subglacial or supraglacial stream flowing between ice walls or in an ice tunnel of a retreating glacier and that was left behind when the ice melted.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially. Normally a constructional landform built of sediment deposited during overflow and lateral migration of the streams.

Forb. Any herbaceous plant not a grass or a sedge.

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 (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial. Of or relating to the presence and activities of ice and glaciers, as glacial erosion. Pertaining to distinctive features and materials produced by or derived from glaciers and ice sheets, as glacial lakes. Pertaining to an ice age or region of glaciation.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glacier. A large mass of ice formed, at least in part, on land by the compaction and recrystallization of snow, moving slowly by creep downslope or outward in all directions due to the stress of its own weight and surviving from year to year.

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 outwash plains, valley trains, deltas, kames, eskers, and kame terraces.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated with varves.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground moraine. An extensive, fairly even layer of till having an undulating surface; a deposit of rock debris dragged along, in, on, and beneath a glacier and emplaced by processes including basal lodgment and release from downwasting stagnant ice.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, generally of restricted summit area (relative to a tableland) and having a well defined outline; slopes generally are more than 15 percent.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

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.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Interfluve. The relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. Any elevated area between two drainageways that sheds water to those drainageways.

Kame (geology). A low mound, knob, hummock, or short irregular ridge composed of stratified sand and gravel deposited by a subglacial stream as a fan or delta at the margin of a melting glacier; by a supraglacial stream in a low place or hole on the surface of the glacier; or as a ponded deposit on the surface or at the margin of stagnant ice.

Kame terrace. A terrace-like ridge consisting of stratified sand and gravel that was deposited by a meltwater stream flowing between a melting glacier and a higher valley wall or lateral moraine and that was left standing after the ice disappeared. It is commonly pitted with “kettles” and has an irregular ice-contact slope.

Kettle. A steep-sided, bowlshaped depression without surface drainage. It is in glacial drift deposits and is believed to have formed by the melting of a large, detached block of stagnant ice buried in the glacial drift.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit (geology). Sediments and chemical precipitates deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain. A nearly level surface marking the floor of an extinct lake filled in by well sorted, fine textured, stratified sediments.

Lake terrace. A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level fell.

Landform. Any physical, recognizable form or feature on the earth’s surface having a characteristic shape and produced by natural causes. It includes major forms, such as a plain, plateau, or mountain, and minor forms, such as a hill, valley, slope, esker, or dune.

Landscape. The distinct association of landforms, especially as modified by geologic forces, that can be seen in a single view.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions (35 to 65 percent of each). It formed primarily under freshwater lacustrine conditions, but varieties associated with more saline environments also occur.

Marsh. A water-saturated, poorly drained area, intermittently or permanently covered with water, having aquatic and grasslike vegetation, essentially without the formation of peat.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Moraine (geology). An accumulation of drift, with an initial topographic expression of its own, built chiefly by the direct action of glacial ice. Examples are end, round, lateral, recessional, and terminal moraines.

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. Highly decomposed organic material in which the original plant parts are not recognizable. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Mucky peat. Organic soil material intermediate in degree of decomposition between the less decomposed peat and the more decomposed muck.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash. Stratified detritus (chiefly sand and gravel) removed or "washed out" from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of an active glacier. The coarser material is deposited nearer to the ice. Also, the meltwater of a glacier.

Outwash plain. An extensive lowland area of coarse textured glaciofluvial material. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Outwash terrace. A valley train deposit extending along a valley downstream from an outwash plain or terminal moraine; a flat-topped bank of outwash with an abrupt outer face.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. The least decomposed of all organic 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.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitted outwash. Outwash with pits or kettles, produced by the partial or complete burial of glacial ice by outwash and the subsequent thaw of the ice and collapse of the surficial materials.

Plain. An extensive lowland area that ranges from level to gently sloping or undulating. A plain has few or no prominent hills or valleys and typically occurs at low elevations relative to the surrounding areas. Where dissected, remnants of a plain can form the local uplands.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proglacial lake. A lake occupying a basin in front of a glacier, generally in direct contact with the ice.

Ravine. A small stream channel that is narrow, steep sided, and commonly V-shaped in cross-section and is larger than a gully.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	below 3.5
Extremely acid	3.5 to 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits. Soil scientists regard as soil only that part of the regolith that is modified by organisms and other soil-forming forces. Most engineers describe the whole regolith, even to a great depth, as soil.

Relief. The elevations or inequalities of a land surface, considered collectively.

Ridge. A long, narrow elevation of the land surface, typically sharp crested with steep sides and forming an extended upland between valleys.

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.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Scarp. An escarpment, cliff, or steep slope of some extent along the margin of a plateau, mesa, terrace, or bench. A scarp may be of any height.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

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. For map units 11B through 111B in this survey, the slope classes are defined as follows:

A—Nearly level	0 to 3 percent
B—Nearly level and undulating	0 to 6 percent
B—Undulating	2 to 6 percent
B—Nearly level and gently undulating	0 to 4 percent
C—Gently rolling	6 to 12 percent
D—Hilly	12 to 18 percent
E—Steep	18 to 35 percent
F—Very steep	35 percent and higher

For map units 209B through 282, the slope classes are defined as follows:

A—Nearly level	0 to 3 percent
B—Nearly level and undulating	0 to 6 percent
C—Gently rolling and rolling	6 to 18 percent
D—Hilly and steep	18 to 30 percent
E—Very steep	30 to 50 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stratified. Formed, arranged, or laid down in layers. The term refers to geologic deposits. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream and representing the dissected remnants of an abandoned flood plain, stream bed, or valley floor produced during a former stage of erosion or deposition.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Swale. A slight depression, sometimes swampy, in the midst of generally level land, or a shallow depression in an undulating ground moraine caused by uneven glacial deposition. Also, a long, narrow, generally shallow, trough-like depression between two beach ridges and aligned roughly parallel to the coastline.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace (geologic). A steplike surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lake, or sea shore. The term is usually applied to both the relatively flat summit surface (platform, tread), cut or built by stream or wave action, and the steeper descending slope (scarp, riser), graded to a lower base level of erosion.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Till. Dominantly unsorted and unstratified drift deposited by a glacier and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley train. A long narrow body of outwash confined within a valley beyond a glacier; it may or may not emerge from the valley and join an outwash plain.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Wave-built terrace. A gently sloping coastal feature at the seaward or lakeward edge of a wave-cut platform, constructed by sediment brought by rivers or drifted along the shore or across the platform and deposited in the deeper water beyond.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

Table 1.--Temperature and Precipitation

(Recorded in the period 1951-80 at East Tawas and Hale, Michigan)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
EAST TAWAS:											
January----	28.9	11.0	20.0	47	-17	0	1.62	0.78	2.35	5	13.4
February---	31.4	11.3	21.4	48	-17	0	1.27	.68	1.79	4	10.2
March------	39.4	20.5	30.0	64	-6	1	1.99	1.24	2.67	5	8.9
April------	53.2	31.9	42.6	81	12	34	2.64	1.83	3.38	7	2.3
May--------	65.4	41.3	53.4	89	24	169	2.86	1.64	3.93	6	.1
June-------	75.0	50.9	63.0	93	33	384	3.17	1.85	4.35	7	.0
July-------	79.9	55.8	67.9	94	40	560	2.94	1.56	4.15	6	.0
August-----	78.2	54.7	66.5	93	38	518	3.08	1.65	4.33	6	.0
September--	70.7	47.7	59.2	90	28	296	2.94	1.42	4.28	6	.0
October----	59.6	38.6	49.1	80	18	89	2.31	1.06	3.38	5	.0
November---	45.4	28.8	37.1	67	7	5	2.43	1.63	3.16	6	3.3
December---	33.7	18.1	25.9	55	-6	0	2.21	1.16	3.14	6	11.3
Yearly:											
Average---	55.1	34.2	44.6	---	---	---	---	---	---	---	---
Extreme---	---	---	---	97	-19	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,056	29.46	26.18	33.07	69	49.5
HALE:											
January----	27.3	7.9	17.6	48	-23	0	1.52	0.74	2.19	4	12.6
February---	30.1	7.7	18.9	50	-24	0	1.22	.66	1.72	4	9.3
March------	39.6	17.3	28.5	65	-15	1	1.84	1.10	2.50	5	10.5
April------	54.0	30.2	42.1	81	10	34	2.53	1.70	3.29	6	2.9
May--------	66.9	40.3	53.6	88	24	177	2.75	1.53	3.83	6	.1
June-------	76.1	50.0	63.1	92	33	400	2.76	1.43	3.92	6	.0
July-------	80.3	54.7	67.5	93	40	550	3.12	1.85	4.26	6	.0
August-----	78.1	53.5	65.8	92	38	498	3.06	1.72	4.24	6	.0
September--	69.9	46.2	58.1	89	29	264	2.95	1.52	4.19	6	.0
October----	59.3	36.9	48.1	81	19	84	2.25	.99	3.32	6	.2
November---	44.2	27.7	36.0	68	5	6	2.26	1.49	2.96	6	4.1
December---	32.0	15.8	23.9	56	-15	0	1.79	.93	2.54	5	11.1
Yearly:											
Average---	54.8	32.4	43.6	---	---	---	---	---	---	---	---
Extreme---	---	---	---	95	-27	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,014	28.05	24.79	31.18	66	50.8

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1951-80 at East Tawas and Hale, Michigan)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
EAST TAWAS:			
Last freezing temperature in spring:			
1 year in 10 later than--	May 4	May 27	June 4
2 years in 10 later than--	Apr. 29	May 21	May 30
5 years in 10 later than--	Apr. 19	May 8	May 20
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 5	Sept. 30	Sept. 16
2 years in 10 earlier than--	Oct. 12	Oct. 4	Sept. 20
5 years in 10 earlier than--	Oct. 24	Oct. 13	Sept. 29
HALE:			
Last freezing temperature in spring:			
1 year in 10 later than--	May 4	May 19	June 4
2 years in 10 later than--	Apr. 30	May 16	May 30
5 years in 10 later than--	Apr. 21	May 9	May 20
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 9	Sept. 25	Sept. 16
2 years in 10 earlier than--	Oct. 15	Sept. 30	Sept. 20
5 years in 10 earlier than--	Oct. 26	Oct. 10	Sept. 28

Table 3.--Growing Season

(Recorded in the period 1951-80 at East Tawas and Hale, Michigan)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
EAST TAWAS:			
9 years in 10	166	132	110
8 years in 10	173	140	117
5 years in 10	187	157	131
2 years in 10	201	173	145
1 year in 10	209	182	152
HALE:			
9 years in 10	167	133	108
8 years in 10	174	140	115
5 years in 10	187	153	130
2 years in 10	200	165	144
1 year in 10	207	172	152

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
11B	Eastport sand, 0 to 6 percent slopes	392	0.1
12B	Tawas-Au Gres complex, 0 to 4 percent slopes	5,984	1.3
16B	Graycalm sand, 0 to 6 percent slopes	5,700	1.3
16C	Graycalm sand, 6 to 12 percent slopes	4,329	1.0
16D	Graycalm sand, 12 to 18 percent slopes	4,230	1.0
16E	Graycalm sand, 18 to 35 percent slopes	1,562	0.4
17B	Croswell sand, 0 to 6 percent slopes	2,532	0.6
18A	Au Gres sand, 0 to 3 percent slopes	5,481	1.2
19	Leafriver muck	3,657	0.8
26B	Croswell sand, loamy substratum, 0 to 6 percent slopes	2,465	0.6
27A	Au Gres sand, clayey substratum, 0 to 3 percent slopes	2,098	0.5
28B	East Lake sand, 0 to 6 percent slopes	2,283	0.5
28C	East Lake sand, 6 to 12 percent slopes	283	0.1
28E	East Lake sand, 12 to 35 percent slopes	132	*
29A	Battlefield sand, 0 to 3 percent slopes	2,502	0.6
30	Wheatley muck	1,734	0.4
31B	Klacking loamy sand, 0 to 6 percent slopes	6,111	1.4
31C	Klacking loamy sand, 6 to 12 percent slopes	10,094	2.3
31D	Klacking loamy sand, 12 to 18 percent slopes	4,112	0.9
31E	Klacking loamy sand, 18 to 35 percent slopes	247	0.1
33B	Mancelona loamy sand, 0 to 6 percent slopes	3,670	0.8
33C	Mancelona loamy sand, 6 to 12 percent slopes	1,906	0.4
33D	Mancelona loamy sand, 12 to 18 percent slopes	1,711	0.4
33E	Mancelona loamy sand, 18 to 35 percent slopes	756	0.2
35	Kinross muck	225	0.1
36B	Alcona loamy very fine sand, moderately wet, 0 to 6 percent slopes	4,933	1.1
36C	Alcona loamy very fine sand, moderately wet, 6 to 12 percent slopes	2,385	0.5
37A	Richter loamy fine sand, 0 to 3 percent slopes	5,394	1.2
38	Tonkey silt loam	2,997	0.7
39B	Glennie loamy sand, moderately wet, 0 to 6 percent slopes	6,218	1.4
39C	Glennie loamy sand, moderately wet, 6 to 12 percent slopes	3,361	0.8
40A	Sprinkler sandy loam, 0 to 3 percent slopes	1,299	0.3
41B	McGinn loamy sand, 0 to 6 percent slopes	5,673	1.3
41C	McGinn loamy sand, 6 to 12 percent slopes	15,746	3.5
41D	McGinn loamy sand, 12 to 18 percent slopes	5,925	1.3
42A	Killmaster sandy loam, 0 to 3 percent slopes	4,860	1.1
43	Wakeley mucky sand	2,680	0.6
44B	Bamfield fine sandy loam, moderately wet, 0 to 6 percent slopes	3,343	0.8
45B	Hoist sandy loam, moderately wet, 0 to 6 percent slopes	7,373	1.7
45C	Hoist sandy loam, moderately wet, 6 to 12 percent slopes	3,976	0.9
46	Ensley mucky sandy loam	1,981	0.4
53B	Negwegon silt loam, moderately wet, 2 to 6 percent slopes	5,078	1.1
53C	Negwegon silt loam, moderately wet, 6 to 12 percent slopes	3,105	0.7
54A	Algonquin silt loam, 0 to 3 percent slopes	9,169	2.1
55	Springport clay loam	3,715	0.8
56B	Nester loam, moderately wet, 0 to 6 percent slopes	2,436	0.5
56C	Nester loam, moderately wet, 6 to 12 percent slopes	2,551	0.6
57B	Kawkawlin loam, 1 to 4 percent slopes	2,736	0.6
59B	Algonquin-Springport complex, 0 to 6 percent slopes	7,211	1.6
60D	Glennie loamy sand, 12 to 18 percent slopes	1,709	0.4
60E	Glennie loamy sand, 18 to 35 percent slopes	277	0.1
61C	Manistee loamy sand, 6 to 12 percent slopes	662	0.1
61D	Manistee loamy sand, 12 to 18 percent slopes	194	*
61F	Manistee loamy sand, 25 to 45 percent slopes	158	*
62A	Allendale loamy sand, 0 to 3 percent slopes	3,089	0.7
63C	Bamfield fine sandy loam, 6 to 12 percent slopes	3,292	0.7
63D	Bamfield fine sandy loam, 12 to 18 percent slopes	1,815	0.4
63F	Bamfield fine sandy loam, 25 to 45 percent slopes	929	0.2
66D	Alcona loamy very fine sand, 12 to 18 percent slopes	642	0.1
66E	Alcona loamy very fine sand, 18 to 35 percent slopes	204	*
68	Rondeau muck	73	*
69	Loxley peat	993	0.2

See footnote at end of table.

Table 4.--Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
70	Lupton muck	17,342	3.9
71	Tawas muck	9,003	2.0
72	Dorval muck	1,297	0.3
73	Markey muck	144	*
74C2	Negwegon silty clay loam, moderately wet, 6 to 12 percent slopes, eroded	260	0.1
77	Waucedah muck, frequently flooded	2,183	0.5
78	Pits, borrow	614	0.1
80F	Zimmerman-Alcona complex, 25 to 60 percent slopes	1,315	0.3
81B	Grayling sand, 0 to 6 percent slopes	2,639	0.6
81C	Grayling sand, 6 to 12 percent slopes	367	0.1
81E	Grayling sand, 18 to 35 percent slopes	581	0.1
82C	Udorthents, loamy, nearly level to gently rolling	207	*
83F	Udipsamments, nearly level to very steep	105	*
84B	Zimmerman loamy fine sand, 0 to 6 percent slopes	1,408	0.3
84C	Zimmerman loamy fine sand, 6 to 12 percent slopes	1,533	0.3
84D	Zimmerman loamy fine sand, 12 to 18 percent slopes	670	0.2
85B	Zimmerman-Alcona, moderately wet, complex, 0 to 6 percent slopes	2,724	0.6
85D	Zimmerman-Alcona, moderately wet, complex, 6 to 18 percent slopes	5,890	1.3
86	Histosols and Aquents, ponded	3,380	0.8
87	Ausable muck, frequently flooded	2,442	0.5
88D	Hoist sandy loam, 12 to 18 percent slopes	851	0.2
89F	Bamfield-Lupton complex, 0 to 45 percent slopes	3,633	0.8
90B	Chinwhisker sand, 0 to 4 percent slopes	5,744	1.3
91E	Glennie-Lupton complex, 0 to 35 percent slopes	4,062	0.9
92B	Klacking-McGinn loamy sands, 0 to 6 percent slopes	2,445	0.5
93B	Au Gres, clayey substratum-Wakeley complex, 0 to 4 percent slopes	16,040	3.6
94F	Klacking-McGinn loamy sands, 8 to 50 percent slopes, dissected	24,690	5.5
96D2	Negwegon silty clay loam, 12 to 18 percent slopes, eroded	115	*
97	Colonville very fine sandy loam, occasionally flooded	335	0.1
98C	Graycalm sand, pitted outwash, 0 to 12 percent slopes	906	0.2
102D	Nester loam, 12 to 18 percent slopes	629	0.1
102E	Nester loam, 18 to 25 percent slopes	232	0.1
102F	Nester loam, 25 to 45 percent slopes	471	0.1
110D	Negwegon silt loam, 12 to 18 percent slopes	946	0.2
110F	Negwegon silt loam, 25 to 45 percent slopes	537	0.1
111B	Manistee loamy sand, moderately wet, 0 to 6 percent slopes	1,340	0.3
209B	Grayling sand, calcareous substratum, nearly level and undulating	10,867	2.4
210B	Grayling sand, nearly level and undulating	5,042	1.1
210C	Grayling sand, rolling	1,580	0.4
210D	Grayling sand, hilly	472	0.1
211B	Grayling sand, banded substratum, nearly level and undulating	5,581	1.3
211C	Grayling sand, banded substratum, rolling	949	0.2
212B	Grayling sand, very deep water table, nearly level and undulating	734	0.2
213B	Graycalm sand, nearly level and undulating	673	0.2
213C	Graycalm sand, rolling	272	0.1
215C	Typic Udipsamments, loamy substratum, rolling	89	*
220B	Typic Udipsamments, nearly level and undulating	2,351	0.5
220C	Typic Udipsamments, rolling	816	0.2
220D	Typic Udipsamments, hilly	184	*
220E	Typic Udipsamments, steep	154	*
221B	Typic Udipsamments, banded substratum, nearly level and undulating	5,700	1.3
221C	Typic Udipsamments, banded substratum, rolling	4,725	1.1
221D	Typic Udipsamments, banded substratum, hilly	398	0.1
222B	Typic Udipsamments, very deep water table, nearly level and undulating	2,142	0.5
223B	Graycalm-Grayling sands, nearly level and undulating	3,474	0.8
223C	Graycalm-Grayling sands, rolling	4,431	1.0
223D	Graycalm-Grayling sands, hilly	187	*
224B	Croswell sand, nearly level and undulating	2,787	0.6
225B	Entic Haplorthods, sandy, loamy substratum, nearly level and undulating	897	0.2
225C	Entic Haplorthods, sandy, loamy substratum, rolling	1,335	0.3
230C	Entic Haplorthods, sandy-Alfic Haplorthods, sandy, complex, rolling	599	0.1

See footnote at end of table.

Table 4.--Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
231B	Entic Haplorthods, sandy, banded substratum-Alfic Haplorthods, sandy, complex, nearly level and undulating	1,412	0.3
231C	Entic Haplorthods, sandy, banded substratum-Alfic Haplorthods, sandy, complex, rolling	1,364	0.3
231D	Entic Haplorthods, sandy, banded substratum-Alfic Haplorthods, sandy, complex, hilly	656	0.1
232B	Entic Haplorthods, sandy-Alfic Haplorthods, sandy, complex, very deep water table, nearly level and undulating	1,812	0.4
233B	Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine-loamy banded substratum, complex, nearly level and undulating	1,631	0.4
233C	Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine-loamy banded substratum, complex, rolling	3,182	0.7
233D	Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine-loamy banded substratum, complex, hilly	528	0.1
235B	Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy, complex, nearly level and undulating	4,708	1.1
235C	Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy, complex, rolling	10,103	2.3
235D	Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy, complex, hilly	2,721	0.6
236B	Arenic Eutroboralfs, nearly level and undulating	91	*
236C	Arenic Eutroboralfs, rolling	673	0.2
237B	Glossic Eutroboralfs, nearly level and undulating	1,713	0.4
237C	Glossic Eutroboralfs, rolling	2,915	0.7
237D	Glossic Eutroboralfs, hilly	435	0.1
247B	Glennie-Bamfield complex, nearly level and undulating	375	0.1
247C	Glennie-Bamfield complex, rolling	1,489	0.3
247D	Glennie-Bamfield complex, hilly	157	*
250D	Glossic Eutroboralfs-Borosaprists, euic, complex, nearly level to hilly	715	0.2
252A	Borosaprists, euic-Au Gres complex, nearly level	274	0.1
253A	Au Gres-Allendale-Croswell sands, nearly level	1,921	0.4
262A	Au Gres sand, nearly level	1,363	0.3
263A	Alfic Haplaquods, nearly level	2,099	0.5
264A	Allendale loamy sand, nearly level	261	0.1
272	Haplaquods-Fluvaquents complex	1,519	0.3
273	Leafriver-Wakeley complex	2,084	0.5
274	Typic Haplaquods	567	0.1
280	Aquents and Histosols, ponded	447	0.1
281	Borosaprists, dysic	1,473	0.3
282	Borosaprists, euic	5,690	1.3
	Water areas less than 40 acres in size	4,291	1.0
	Water areas more than 40 acres in size	10,560	2.4
	Total	445,126	100.0

* Less than 0.05 percent.

Table 5.--Prime Farmland

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
36B	Alcona loamy very fine sand, moderately wet, 0 to 6 percent slopes
37A	Richter loamy fine sand, 0 to 3 percent slopes (where drained)
38	Tonkey silt loam (where drained)
40A	Sprinkler sandy loam, 0 to 3 percent slopes (where drained)
41B	McGinn loamy sand, 0 to 6 percent slopes
42A	Killmaster sandy loam, 0 to 3 percent slopes (where drained)
44B	Bamfield fine sandy loam, moderately wet, 0 to 6 percent slopes
45B	Hoist sandy loam, moderately wet, 0 to 6 percent slopes
46	Ensley mucky sandy loam (where drained)
53B	Negwegon silt loam, moderately wet, 2 to 6 percent slopes
54A	Algonquin silt loam, 0 to 3 percent slopes (where drained)
55	Springport clay loam (where drained)
56B	Nester loam, moderately wet, 0 to 6 percent slopes
57B	Kawkawlin loam, 1 to 4 percent slopes (where drained)
59B	Algonquin-Springport complex, 0 to 6 percent slopes (where drained)
97	Colonville very fine sandy loam, occasionally flooded (where drained)

Table 6.--Land Capability and Yields per Acre of Crops

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Corn, silage	Oats	Alfalfa hay	Winter wheat
		Bu	Tons	Bu	Tons	Bu
11B----------------------- Eastport	VIs	---	---	---	---	---
12B----------------------- Tawas-Au Gres	VIw	---	---	---	---	---
16B----------------------- Graycalm	IVs	---	---	---	---	---
16C, 16D------------------ Graycalm	VIs	---	---	---	2.3	---
16E----------------------- Graycalm	VIIs	---	---	---	---	---
17B----------------------- Croswell	IVs	50	9	50	2.5	25
18A----------------------- Au Gres	IVw	55	10	45	---	25
19------------------------ Leafriver	VIw	---	---	---	---	---
26B----------------------- Croswell	IVs	---	---	50	2.5	25
27A----------------------- Au Gres	IVw	---	---	---	---	---
28B----------------------- East Lake	IVs	---	---	---	---	---
28C----------------------- East Lake	VIs	---	---	---	---	---
28E----------------------- East Lake	VIIs	---	---	---	---	---
29A----------------------- Battlefield	IVw	---	---	---	---	---
30------------------------ Wheatley	Vw	---	---	---	---	---
31B----------------------- Klacking	IIIs	---	11	60	3.0	---
31C----------------------- Klacking	IIIe	---	---	---	---	---
31D----------------------- Klacking	IVe	---	---	---	---	---
31E----------------------- Klacking	VIIe	---	---	---	---	---
33B----------------------- Mancelona	IIIs	65	12	60	2.8	28

Table 6.--Land Capability and Yields per Acre of Crops--Continued

Soil name and map symbol	Land capability	Corn	Corn, silage	Oats	Alfalfa hay	Winter wheat
		Bu	Tons	Bu	Tons	Bu
33C----------------------- Mancelona	IIIe	60	11	55	2.4	24
33D----------------------- Mancelona	IVe	---	---	---	---	---
33E----------------------- Mancelona	VIIe	---	---	---	---	---
35------------------------ Kinross	VIw	---	---	---	---	---
36B----------------------- Alcona	IIe	85	13	75	3.5	35
36C----------------------- Alcona	IIIe	75	11	65	3.2	30
37A----------------------- Richter	IIw	85	14	80	3.5	35
38------------------------ Tonkey	Vw	---	---	---	---	---
39B----------------------- Glennie	IIIs	75	12	---	3.5	---
39C----------------------- Glennie	IIIe	70	11	---	3.2	---
40A----------------------- Sprinkler	IIw	80	13	80	---	---
41B----------------------- McGinn	IIIs	65	11	60	3.0	---
41C----------------------- McGinn	IIIe	60	11	55	2.6	---
41D----------------------- McGinn	IVe	---	---	---	---	---
42A----------------------- Killmaster	IIw	---	14	80	---	35
43------------------------ Wakeley	Vw	---	---	---	---	---
44B----------------------- Bamfield	IIe	85	14	76	4.0	---
45B----------------------- Hoist	IIe	80	15	75	3.8	---
45C----------------------- Hoist	IIIe	75	13	70	3.6	---
46------------------------ Ensley	Vw	---	---	---	---	---
53B----------------------- Negwegon	IIIe	75	12	70	3.5	---

Table 6.--Land Capability and Yields per Acre of Crops--Continued

Soil name and map symbol	Land capability	Corn	Corn, silage	Oats	Alfalfa hay	Winter wheat
		Bu	Tons	Bu	Tons	Bu
53C------------------------ Negwegon	IIIe	68	10	65	3.1	---
54A------------------------ Algonquin	IIIw	80	13	75	3.5	---
55------------------------- Springport	IIIw	85	14	75	3.5	---
56B------------------------ Nester	IIe	80	14	75	3.7	40
56C------------------------ Nester	IIIe	70	13	70	3.5	36
57B------------------------ Kawkawlin	IIe	85	16	80	3.8	42
59B------------------------ Algonquin-Springport	IIIe	56	9	52	2.5	---
60D------------------------ Glennie	IVe	---	---	---	---	---
60E------------------------ Glennie	VIIe	---	---	---	---	---
61C------------------------ Manistee	IIIe	65	12	65	3.2	30
61D------------------------ Manistee	IVe	---	---	---	---	---
61F------------------------ Manistee	VIIe	---	---	---	---	---
62A------------------------ Allendale	IIIw	85	14	75	3.5	40
63C------------------------ Bamfield	IIIe	80	13	75	3.5	---
63D------------------------ Bamfield	IVe	---	---	---	---	---
63F------------------------ Bamfield	VIIe	---	---	---	---	---
66D------------------------ Alcona	IVe	---	---	---	---	---
66E------------------------ Alcona	VIIe	---	---	---	---	---
68------------------------- Rondeau	VIw	---	---	---	---	---
69------------------------- Loxley	VIIw	---	---	---	---	---
70------------------------- Lupton	VIw	---	---	---	---	---

Table 6.--Land Capability and Yields per Acre of Crops--Continued

Soil name and map symbol	Land capability	Corn	Corn, silage	Oats	Alfalfa hay	Winter wheat
		Bu	Tons	Bu	Tons	Bu
71------------------------ Tawas	VIw	---	---	---	---	---
72------------------------ Dorval	Vw	---	---	---	---	---
73------------------------ Markey	Vw	---	---	---	---	---
74C2---------------------- Negwegon	IIIe	65	9	60	3.0	---
77------------------------ Waucedah	Vw	---	---	---	---	---
78 Pits						
80F----------------------- Zimmerman-Alcona	VIIe	---	---	---	---	---
81B, 81C------------------ Grayling	VIs	---	---	---	---	---
81E----------------------- Grayling	VIIs	---	---	---	---	---
82C. Udorthents						
83F. Udipsamments						
84B----------------------- Zimmerman	IVs	---	---	---	---	---
84C, 84D------------------ Zimmerman	VIs	---	---	---	---	---
85B----------------------- Zimmerman-Alcona	IVs	66	12	56	---	---
85D----------------------- Zimmerman-Alcona	VIs	---	---	---	---	---
86. Histosols and Aquents						
87------------------------ Ausable	VIIw	---	---	---	---	---
88D----------------------- Hoist	IVe	70	11	60	3.4	---
89F----------------------- Bamfield-Lupton	VIIe	---	---	---	---	---
90B----------------------- Chinwhisker	IVs	---	---	---	---	---

Table 6.--Land Capability and Yields per Acre of Crops--Continued

Soil name and map symbol	Land capability	Corn	Corn, silage	Oats	Alfalfa hay	Winter wheat
		Bu	Tons	Bu	Tons	Bu
91E. Glennie-Lupton	VIe	---	---	---	---	---
92B. Klacking-McGinn	IIIs	---	---	---	---	---
93B. Au Gres-Wakeley	IVw	---	---	---	---	---
94F. Klacking-McGinn	VIIe	---	---	---	---	---
96D2. Negwegon	IVe	---	---	---	2.8	---
97. Colonville	Vw	---	---	---	---	---
98C. Graycalm	VIs	---	---	---	---	---
102D. Nester	IVe	60	11	65	3.1	32
102E. Nester	VIe	---	---	---	2.7	---
102F. Nester	VIIe	---	---	---	---	---
110D. Negwegon	IVe	---	---	---	2.8	---
110F. Negwegon	VIIe	---	---	---	---	---
111B. Manistee	IIIs	75	12	70	3.5	35
209B, 210B. Grayling	VIs	---	---	---	---	---
210C. Grayling	VIIs	---	---	---	---	---
210D. Grayling	VIIs	---	---	---	---	---
211B. Grayling	VIs	---	---	---	---	---
211C. Grayling	VIIs	---	---	---	---	---
212B. Grayling	VIs	---	---	---	---	---
213B. Graycalm	IVs	---	---	---	---	---

Table 6.--Land Capability and Yields per Acre of Crops--Continued

Soil name and map symbol	Land capability	Corn	Corn, silage	Oats	Alfalfa hay	Winter wheat
		Bu	Tons	Bu	Tons	Bu
213C---------------------- Graycalm	VIs	---	---	---	2.3	---
215C---------------------- Typic Udipsamments	VIIs	---	---	---	---	---
220B---------------------- Typic Udipsamments	VIs	---	---	---	---	---
220C---------------------- Typic Udipsamments	VIIs	---	---	---	---	---
220D, 220E---------------- Typic Udipsamments	VIIs	---	---	---	---	---
221B---------------------- Typic Udipsamments	VIs	---	---	---	---	---
221C, 221D---------------- Typic Udipsamments	VIIs	---	---	---	---	---
222B---------------------- Typic Udipsamments	VIs	---	---	---	---	---
223B---------------------- Graycalm-Grayling	IVs	---	---	---	---	---
223C---------------------- Graycalm-Grayling	VIs	---	---	---	---	---
223D---------------------- Graycalm-Grayling	VIIs	---	---	---	---	---
224B---------------------- Croswell	IVs	---	---	---	---	---
225B---------------------- Entic Haplorthods	VIs	---	---	---	---	---
225C---------------------- Entic Haplorthods	VIIs	---	---	---	---	---
230C---------------------- Entic Haplorthods-Alfic Haplorthods	VIIs	---	---	---	---	---
231B---------------------- Entic Haplorthods-Alfic Haplorthods	VIs	---	---	---	---	---
231C, 231D---------------- Entic Haplorthods-Alfic Haplorthods	VIIs	---	---	---	---	---
232B---------------------- Entic Haplorthods-Alfic Haplorthods	VIs	---	---	---	---	---
233B---------------------- Alfic Haplorthods-Entic Haplorthods	IIIs	---	---	---	---	---

Table 6.--Land Capability and Yields per Acre of Crops--Continued

Soil name and map symbol	Land capability	Corn	Corn, silage	Oats	Alfalfa hay	Winter wheat
		Bu	Tons	Bu	Tons	Bu
233C----------------------- Alfic Haplorthods-Entic Haplorthods	IVe	---	---	---	---	---
233D----------------------- Alfic Haplorthods-Entic Haplorthods	VIIe	---	---	---	---	---
235B----------------------- Alfic Haplorthods-Alfic Haplorthods	IIIs	---	---	---	---	---
235C----------------------- Alfic Haplorthods-Alfic Haplorthods	IVe	---	---	---	---	---
235D----------------------- Alfic Haplorthods-Alfic Haplorthods	VIIe	---	---	---	---	---
236B, 236C. Arenic Eutroboralfs						
237B, 237C, 237D. Glossic Eutroboralfs						
247B----------------------- Glennie-Bamfield	IIIs	---	---	---	---	---
247C----------------------- Glennie-Bamfield	IVe	---	---	---	---	---
247D----------------------- Glennie-Bamfield	VIe	---	---	---	---	---
250D. Glossic Eutroboralfs-Borosaprists						
252A. Borosaprists-Au Gres						
253A----------------------- Au Gres-Allendale-Croswell	IVw	---	---	---	---	---
262A----------------------- Au Gres	IVw	---	---	---	---	---
263A. Alfic Haplaquods						
264A----------------------- Allendale	IIIw	---	---	---	---	---
272. Haplaquods-Fluvaquents						
273------------------------ Leafriver-Wakeley	VIw	---	---	---	---	---

Table 6.--Land Capability and Yields per Acre of Crops--Continued

Soil name and map symbol	Land capability	Corn	Corn, silage	Oats	Alfalfa hay	Winter wheat
		Bu	Tons	Bu	Tons	Bu
274. Typic Haplaquods						
280. Aquents and Histosols						
281, 282. Borosaprists						

Table 7.--Capability Classes and Subclasses

(Miscellaneous areas and taxonomic units mapped above the family level are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	---	---	---	---
II	40,678	29,125	11,553	---
III	101,439	62,716	13,145	25,578
IV	90,871	31,676	29,405	29,790
V	7,661	---	7,661	---
VI	105,142	4,294	38,368	62,480
VII	54,368	36,623	1,962	15,783
VIII	---	---	---	---

Table 8.--Woodland Management and Productivity

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
11B------------- Eastport	5S	Slight	Moderate	Moderate	Slight	Red pine------------	47	69	Red pine, jack pine, eastern white pine.
						Jack pine-----------	---	---	
						Quaking aspen-------	---	---	
						Eastern white pine--	---	---	
						Paper birch---------	---	---	
						Red maple-----------	---	---	
12B:									
Tawas----------	5W	Slight	Severe	Severe	Severe	Balsam fir----------	40	71	---
						Northern whitecedar-	---	---	
						Quaking aspen-------	---	---	
						Black ash-----------	---	---	
						Red maple-----------	---	---	
Au Gres--------	6W	Slight	Severe	Moderate	Severe	Quaking aspen-------	70	81	White spruce, red pine, eastern white pine, Norway spruce.
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
						Red maple-----------	65	40	
						Eastern white pine--	---	---	
						Northern whitecedar-	---	---	
						Jack pine-----------	51	69	
						Red pine------------	61	104	
16B, 16C, 16D--- Graycalm	6S	Slight	Moderate	Moderate	Slight	Bigtooth aspen------	70	81	Red pine, eastern white pine.
						Northern red oak----	62	54	
						Jack pine-----------	56	78	
						Red pine------------	61	104	
						Eastern white pine--	---	---	
						Quaking aspen-------	60	64	
16E------------- Graycalm	6R	Moderate	Moderate	Moderate	Slight	Bigtooth aspen------	70	81	Red pine, eastern white pine.
						Northern red oak----	62	54	
						Jack pine-----------	56	78	
						Red pine------------	61	104	
						Eastern white pine--	---	---	
						Quaking aspen-------	60	64	
17B------------- Croswell	5S	Slight	Moderate	Moderate	Moderate	Quaking aspen-------	68	78	Red pine, eastern white pine, white spruce.
						Red pine------------	55	88	
						Jack pine-----------	53	73	
						Northern red oak----	---	---	
						Black cherry--------	---	---	
						Eastern white pine--	---	---	
						Bigtooth aspen------	69	80	
						Red maple-----------	---	---	
						Paper birch---------	54	55	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
18A------------- Au Gres	6W	Slight	Severe	Moderate	Severe	Quaking aspen-------	70	81	White spruce, red pine, eastern white pine, Norway spruce.
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
						Red maple-----------	65	40	
						Eastern white pine--	---	---	
						Northern whitecedar-	---	---	
						Jack pine-----------	51	69	
						Red pine------------	61	104	
19-------------- Leafriver	2W	Slight	Severe	Severe	Severe	Quaking aspen-------	45	32	---
						Northern whitecedar-	---	---	
						Tamarack------------	---	---	
						Black spruce--------	---	---	
26B------------- Croswell	7S	Slight	Moderate	Moderate	Slight	Red pine------------	60	107	Red pine, eastern white pine, jack pine.
						Jack pine-----------	---	---	
						Eastern white pine--	---	---	
						Northern pin oak----	---	---	
						Quaking aspen-------	---	---	
						Bigtooth aspen------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
						American basswood---	---	---	
						Paper birch---------	---	---	
27A------------- Au Gres	7W	Slight	Severe	Moderate	Moderate	Red pine------------	58	96	Red pine, eastern white pine, white spruce.
						Eastern white pine--	---	---	
						Paper birch---------	---	---	
						Quaking aspen-------	---	---	
28B, 28C-------- East Lake	2S	Slight	Moderate	Moderate	Slight	Red maple-----------	53	34	Red pine, jack pine, eastern white pine.
						Northern red oak----	---	---	
						Quaking aspen-------	---	---	
						Red pine------------	55	88	
						Jack pine-----------	---	---	
						Paper birch---------	---	---	
28E------------- East Lake	2R	Moderate	Moderate	Moderate	Slight	Red maple-----------	53	34	Red pine, jack pine, eastern white pine.
						Northern red oak----	---	---	
						Quaking aspen-------	---	---	
						Red pine------------	55	88	
						Jack pine-----------	---	---	
						Paper birch---------	---	---	
29A------------- Battlefield	5W	Slight	Severe	Moderate	Severe	Quaking aspen-------	68	78	White spruce.
						Red maple-----------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
30-------------- Wheatley	2W	Slight	Severe	Severe	Severe	Quaking aspen-------	45	32	White spruce, Norway spruce, eastern white pine.
						Balsam fir----------	40	71	
						Northern whitecedar-	15	18	
						Black spruce--------	15	23	
						Red maple-----------	40	24	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
31B, 31C, 31D--- Klacking	6S	Slight	Slight	Moderate	Slight	Bigtooth aspen------ White oak----------- Northern red oak---- Red maple----------- Paper birch---------	70 57 60 --- ---	81 46 51 --- ---	Eastern white pine, red pine.
31E------------- Klacking	6R	Moderate	Moderate	Moderate	Slight	Bigtooth aspen------ White oak----------- Northern red oak---- Red maple----------- Paper birch---------	70 57 60 --- ---	81 46 51 --- ---	Eastern white pine, red pine.
33B, 33C, 33D--- Mancelona	3A	Slight	Slight	Slight	Slight	Northern red oak---- Red pine------------ Jack pine----------- Eastern white pine-- White oak-----------	55 --- --- --- ---	42 --- --- --- ---	Red pine, eastern white pine, jack pine.
33E------------- Mancelona	3R	Moderate	Moderate	Slight	Slight	Northern red oak---- Red pine------------ Jack pine----------- Eastern white pine-- White oak-----------	55 --- --- --- ---	42 --- --- --- ---	Red pine, eastern white pine, jack pine.
35-------------- Kinross	2W	Slight	Severe	Severe	Severe	Quaking aspen------- Black spruce-------- Tamarack------------ Balsam fir---------- Red maple----------- Jack pine----------- Eastern white pine-- Paper birch---------	45 --- --- --- --- --- --- ---	32 --- --- --- --- --- --- ---	---
36B, 36C-------- Alcona	3L	Slight	Moderate	Slight	Slight	Sugar maple--------- Red maple----------- American basswood--- American beech------ Northern red oak---- Eastern white pine-- White ash----------- Red pine------------	61 --- --- --- --- --- --- ---	38 --- --- --- --- --- --- ---	White spruce, red pine, eastern white pine.
37A------------- Richter	3W	Slight	Severe	Moderate	Severe	Red maple----------- Balsam fir---------- Black ash----------- Eastern white pine-- Paper birch--------- Quaking aspen-------	65 --- --- --- 65 ---	40 --- --- --- 73 ---	White spruce, northern whitecedar, eastern white pine.
38-------------- Tonkey	5W	Slight	Severe	Severe	Severe	Quaking aspen------- Balsam fir---------- Northern whitecedar- Red maple----------- Black ash-----------	61 --- --- --- ---	66 --- --- --- ---	---

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
39B, 39C--------Glennie	5D	Slight	Moderate	Slight	Moderate	Northern red oak----	72	69	White spruce, red pine, eastern white pine.
						Red maple-----------	---	---	
						Bigtooth aspen------	---	---	
						Paper birch---------	---	---	
						American beech------	---	---	
						Balsam fir----------	---	---	
						Eastern white pine--	---	---	
						White ash-----------	---	---	
40A-------------Sprinkler	3W	Slight	Severe	Moderate	Severe	Red maple-----------	60	38	White spruce, eastern white pine.
						Paper birch---------	---	---	
						Bigtooth aspen------	---	---	
						Quaking aspen-------	---	---	
						Black ash-----------	---	---	
						Eastern white pine--	---	---	
						Balsam fir----------	---	---	
41B, 41C, 41D---McGinn	4S	Slight	Slight	Slight	Slight	Northern red oak----	67	61	Red pine, white spruce.
						Red pine------------	---	---	
						White oak-----------	65	59	
						Bigtooth aspen------	---	---	
42A-------------Killmaster	4W	Slight	Severe	Slight	Moderate	Bigtooth aspen------	60	64	Eastern white pine, white ash, white spruce.
						Paper birch---------	---	---	
						White spruce--------	---	---	
						Northern red oak----	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
						Balsam fir----------	---	---	
						Red maple-----------	---	---	
43--------------Wakeley	3W	Slight	Severe	Severe	Severe	Quaking aspen-------	50	48	Northern whitecedar.
						Black spruce--------	---	---	
						Balsam fir----------	---	---	
						Northern whitecedar-	---	---	
44B-------------Bamfield	3L	Slight	Moderate	Slight	Moderate	Sugar maple---------	61	38	White spruce, red pine, eastern white pine, Norway spruce.
						Northern red oak----	---	---	
						Bigtooth aspen------	---	---	
						American basswood---	---	---	
						Paper birch---------	---	---	
						American beech------	---	---	
						White ash-----------	---	---	
						Eastern hemlock-----	---	---	
45B, 45C--------Hoist	3L	Slight	Moderate	Slight	Slight	Sugar maple---------	66	41	White spruce, red pine, eastern white pine.
						Northern red oak----	74	72	
						Quaking aspen-------	---	---	
						Eastern white pine--	---	---	
						Red pine------------	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
						Paper birch---------	---	---	
						Balsam fir----------	---	---	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
46-------------- Ensley	3W	Slight	Severe	Severe	Severe	Red maple-----------	62	39	Green ash, white spruce.
						Balsam fir----------	60	118	
						White spruce--------	---	---	
						White ash-----------	---	---	
						Yellow birch--------	---	---	
						Black ash-----------	---	---	
53B, 53C-------- Negwegon	3L	Slight	Moderate	Slight	Moderate	Sugar maple---------	62	39	White spruce, eastern white pine.
						Bigtooth aspen------	---	---	
						White ash-----------	---	---	
						Northern red oak----	---	---	
						Balsam fir----------	---	---	
						Eastern hemlock-----	---	---	
						American beech------	---	---	
54A------------- Algonquin	6W	Slight	Severe	Moderate	Severe	Balsam fir----------	45	83	White spruce, eastern white pine, northern whitecedar.
						Quaking aspen-------	---	---	
						Balsam poplar-------	---	---	
						Paper birch---------	---	---	
						Black ash-----------	---	---	
						Red maple-----------	---	---	
						Northern whitecedar-	---	---	
55-------------- Springport	6W	Slight	Severe	Severe	Severe	Balsam fir----------	45	83	White spruce, eastern white pine, northern whitecedar.
						Quaking aspen-------	---	---	
						Northern whitecedar-	---	---	
						Paper birch---------	---	---	
						Black ash-----------	---	---	
						Balsam poplar-------	---	---	
56B, 56C-------- Nester	3L	Slight	Moderate	Slight	Slight	Sugar maple---------	61	38	White spruce, red pine, eastern white pine.
						Quaking aspen-------	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
						Northern red oak----	---	---	
						White oak-----------	---	---	
						American beech------	---	---	
57B------------- Kawkawlin	3W	Slight	Severe	Slight	Moderate	Sugar maple---------	60	38	White spruce, red pine, Norway spruce, eastern white pine.
						Red maple-----------	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
						Quaking aspen-------	---	---	
						Bigtooth aspen------	---	---	
59B:									
Algonquin------	6W	Slight	Severe	Moderate	Severe	Balsam fir----------	45	83	White spruce, eastern white pine, northern whitecedar.
						Quaking aspen-------	---	---	
						Balsam poplar-------	---	---	
						Paper birch---------	---	---	
						Black ash-----------	---	---	
						Red maple-----------	---	---	
						Northern whitecedar-	---	---	
Springport-----	6W	Slight	Severe	Severe	Severe	Balsam fir----------	45	83	White spruce, eastern white pine, northern whitecedar.
						Quaking aspen-------	---	---	
						Northern whitecedar-	---	---	
						Paper birch---------	---	---	
						Black ash-----------	---	---	
						Balsam poplar-------	---	---	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
60D	5D	Slight	Moderate	Slight	Moderate	Northern red oak	72	69	White spruce, red pine, eastern white pine.
Glennie						Red maple	---	---	
						Bigtooth aspen	---	---	
						Paper birch	---	---	
						American beech	---	---	
						Balsam fir	---	---	
						Eastern white pine	---	---	
						White ash	---	---	
60E	5R	Moderate	Moderate	Slight	Moderate	Northern red oak	72	69	White spruce, red pine, eastern white pine.
Glennie						Red maple	---	---	
						Bigtooth aspen	---	---	
						Paper birch	---	---	
						American beech	---	---	
						Balsam fir	---	---	
						Eastern white pine	---	---	
						White ash	---	---	
61C, 61D	3A	Slight	Slight	Slight	Slight	Sugar maple	67	41	Red pine, eastern white pine.
Manistee						Eastern white pine	---	---	
						Red maple	---	---	
						Red pine	---	---	
						American basswood	---	---	
						Northern red oak	56	44	
						White ash	---	---	
						Bigtooth aspen	74	86	
61F	3R	Severe	Severe	Slight	Slight	Sugar maple	67	41	Red pine, eastern white pine.
Manistee						Eastern white pine	---	---	
						Red maple	---	---	
						Red pine	---	---	
						American basswood	---	---	
						Northern red oak	56	44	
						White ash	---	---	
						Bigtooth aspen	74	86	
62A	4W	Slight	Severe	Slight	Moderate	Quaking aspen	60	64	White spruce, eastern white pine.
Allendale						Eastern white pine	---	---	
						White spruce	---	---	
						Paper birch	---	---	
						Balsam fir	---	---	
						Red maple	---	---	
						Black ash	---	---	
63C, 63D	3L	Slight	Moderate	Slight	Slight	Sugar maple	61	38	Red pine, white spruce, eastern white pine, Norway spruce.
Bamfield						Northern red oak	---	---	
						Bigtooth aspen	---	---	
						American basswood	---	---	
						Paper birch	---	---	
						American beech	---	---	
						White ash	---	---	
						Eastern hemlock	---	---	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
63F------------- Bamfield	3R	Severe	Severe	Slight	Slight	Sugar maple---------	61	38	Red pine, white spruce, eastern white pine, Norway spruce.
						Northern red oak----	---	---	
						Bigtooth aspen------	---	---	
						American basswood---	---	---	
						Paper birch---------	---	---	
						American beech------	---	---	
						White ash-----------	---	---	
						Eastern hemlock-----	---	---	
66D------------- Alcona	3L	Slight	Moderate	Slight	Slight	Sugar maple---------	61	38	White spruce, red pine, eastern white pine.
						Red maple-----------	---	---	
						American basswood---	---	---	
						American beech------	---	---	
						Northern red oak----	---	---	
						Eastern white pine--	---	---	
						White ash-----------	---	---	
						Red pine------------	---	---	
66E------------- Alcona	3R	Moderate	Moderate	Slight	Slight	Sugar maple---------	61	38	White spruce, red pine, eastern white pine.
						Red maple-----------	---	---	
						American basswood---	---	---	
						American beech------	---	---	
						Northern red oak----	---	---	
						Eastern white pine--	---	---	
						White ash-----------	---	---	
						Red pine------------	---	---	
69-------------- Loxley	2W	Slight	Severe	Severe	Severe	Black spruce--------	15	23	---
						Tamarack------------	---	---	
						Balsam fir----------	---	---	
70-------------- Lupton	2W	Slight	Severe	Severe	Severe	Black spruce--------	20	29	---
						Balsam fir----------	46	86	
						Black ash-----------	---	---	
						Northern whitecedar-	---	---	
						Paper birch---------	---	---	
						Tamarack------------	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						White spruce--------	---	---	
71-------------- Tawas	5W	Slight	Severe	Severe	Severe	Balsam fir----------	40	71	---
						Northern whitecedar-	---	---	
						Quaking aspen-------	---	---	
						Black ash-----------	---	---	
						Red maple-----------	---	---	
						Black spruce--------	---	---	
72-------------- Dorval	2W	Slight	Severe	Severe	Severe	Red maple-----------	50	32	Northern whitecedar, white spruce.
						White ash-----------	---	---	
						American elm--------	---	---	
						Northern whitecedar-	---	---	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	Trees to plant
		Management concerns				Potential productivity			
77-------------- Waucedah	3W	Slight	Severe	Severe	Severe	Northern whitecedar-	30	42	---
						Balsam fir----------	40	71	
						Black ash-----------	---	---	
						Quaking aspen-------	40	22	
						Red maple-----------	---	---	
						Black spruce--------	---	---	
80F:									
Zimmerman------	8R	Severe	Severe	Moderate	Slight	Red pine------------	64	112	Red pine, jack pine, eastern white pine, white spruce.
						Quaking aspen-------	70	81	
						Red maple-----------	---	---	
						Paper birch---------	---	---	
						Eastern white pine--	---	---	
Alcona---------	3R	Severe	Severe	Slight	Slight	Sugar maple---------	61	38	White spruce, red pine, eastern white pine.
						Red maple-----------	---	---	
						American basswood---	---	---	
						American beech------	---	---	
						Northern red oak----	---	---	
						Eastern white pine--	---	---	
						White ash-----------	---	---	
						Red pine------------	---	---	
81B, 81C-------- Grayling	4S	Slight	Moderate	Moderate	Slight	Jack pine-----------	48	63	Jack pine, red pine.
						Northern pin oak----	43	28	
						White oak-----------	---	---	
						Red pine------------	---	---	
						Quaking aspen-------	---	---	
81E------------- Grayling	4R	Moderate	Moderate	Moderate	Slight	Jack pine-----------	48	63	Jack pine, red pine.
						Northern pin oak----	43	28	
						White oak-----------	---	---	
						Red pine------------	---	---	
						Quaking aspen-------	---	---	
84B, 84C, 84D--- Zimmerman	8S	Slight	Moderate	Moderate	Slight	Red pine------------	64	112	Red pine, jack pine, eastern white pine, white spruce.
						Quaking aspen-------	70	81	
						Red maple-----------	---	---	
						Jack pine-----------	65	94	
						Paper birch---------	---	---	
85B, 85D:									
Zimmerman------	8S	Slight	Moderate	Moderate	Slight	Red pine------------	64	112	Red pine, jack pine, eastern white pine, white spruce.
						Quaking aspen-------	70	81	
						Red maple-----------	---	---	
						Paper birch---------	---	---	
						Eastern white pine--	---	---	
Alcona---------	3L	Slight	Moderate	Slight	Slight	Sugar maple---------	61	38	White spruce, red pine, eastern white pine.
						Red maple-----------	---	---	
						American basswood---	---	---	
						American beech------	---	---	
						Northern red oak----	---	---	
						Eastern white pine--	---	---	
						White ash-----------	---	---	
						Red pine------------	---	---	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
87-------------- Ausable	2W	Slight	Severe	Severe	Severe	Northern whitecedar-	15	25	---
						Balsam poplar-------	---	---	
						Paper birch---------	---	---	
						Black ash-----------	---	---	
88D------------- Hoist	3L	Slight	Moderate	Slight	Slight	Sugar maple---------	66	41	White spruce, red pine, eastern white pine.
						Northern red oak----	74	72	
						Quaking aspen-------	---	---	
						Eastern white pine--	---	---	
						Red pine------------	---	---	
						White ash-----------	---	---	
						American beech------	---	---	
						American basswood---	---	---	
						Paper birch---------	---	---	
89F:									
Bamfield-------	3R	Moderate	Moderate	Slight	Slight	Sugar maple---------	61	38	Red pine, white spruce, eastern white pine, Norway spruce.
						Northern red oak----	---	---	
						Bigtooth aspen------	---	---	
						American basswood---	---	---	
						Paper birch---------	---	---	
						American beech------	---	---	
						White ash-----------	---	---	
						Eastern hemlock-----	---	---	
Lupton.									
90B------------- Chinwhisker	6S	Slight	Moderate	Moderate	Slight	Bigtooth aspen------	70	81	Jack pine, eastern white pine, white spruce.
						Quaking aspen-------	---	---	
						Jack pine-----------	56	78	
						Paper birch---------	---	---	
						Red maple-----------	---	---	
91E:									
Glennie--------	5R	Moderate	Moderate	Slight	Moderate	Northern red oak----	72	69	White spruce, red pine, eastern white pine.
						Red maple-----------	---	---	
						Bigtooth aspen------	---	---	
						Paper birch---------	---	---	
						American beech------	---	---	
						Balsam fir----------	---	---	
						Eastern white pine--	---	---	
						White ash-----------	---	---	
Lupton.									
92B:									
Klacking-------	6S	Slight	Slight	Moderate	Slight	Bigtooth aspen------	70	81	Eastern white pine, red pine.
						White oak-----------	57	46	
						Northern red oak----	60	51	
						Red maple-----------	---	---	
						Paper birch---------	---	---	
McGinn---------	4S	Slight	Slight	Slight	Slight	Northern red oak----	67	61	Red pine, white spruce.
						Red pine------------	---	---	
						White oak-----------	65	59	
						Bigtooth aspen------	---	---	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
93B:									
Au Gres--------	7W	Slight	Severe	Moderate	Moderate	Red pine------------	58	96	Red pine, eastern white pine, white spruce.
						Eastern white pine--	---	---	
						Paper birch---------	---	---	
						Quaking aspen-------	---	---	
Wakeley--------	3W	Slight	Severe	Severe	Severe	Quaking aspen-------	50	43	Northern whitecedar.
						Black spruce--------	---	---	
						Balsam fir----------	---	---	
						Northern whitecedar-	---	---	
94F:									
Klacking-------	6R	Severe	Severe	Moderate	Slight	Bigtooth aspen------	70	81	Eastern white pine, red pine.
						White oak-----------	57	46	
						Northern red oak----	60	51	
						Red maple-----------	---	---	
						Paper birch---------	---	---	
McGinn---------	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	67	61	Red pine, white spruce.
						Red pine------------	---	---	
						White oak-----------	65	59	
						Bigtooth aspen------	---	---	
97-------------- Colonville	3W	Slight	Severe	Slight	Moderate	Red maple-----------	61	38	White spruce, northern red oak, eastern white pine, northern whitecedar, Norway spruce.
						American basswood---	65	59	
						Northern whitecedar-	45	67	
						White ash-----------	65	59	
						Balsam fir----------	61	120	
						Quaking aspen-------	---	---	
98C------------- Graycalm	6S	Slight	Moderate	Moderate	Slight	Bigtooth aspen------	70	81	Red pine, eastern white pine.
						Northern red oak----	62	54	
						Jack pine-----------	56	78	
						Red pine------------	61	104	
						Eastern white pine--	---	---	
						Quaking aspen-------	60	64	
102D------------ Nester	3L	Slight	Moderate	Slight	Slight	Sugar maple---------	61	38	White spruce, red pine, Norway spruce, eastern white pine.
						Quaking aspen-------	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
						Northern red oak----	---	---	
						White oak-----------	---	---	
						American beech------	---	---	
102E------------ Nester	3R	Moderate	Moderate	Slight	Slight	Sugar maple---------	61	38	White spruce, red pine, Norway spruce, eastern white pine.
						Quaking aspen-------	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
						Northern red oak----	---	---	
						White oak-----------	---	---	
						American beech------	---	---	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
102F------------ Nester	3R	Severe	Severe	Slight	Slight	Sugar maple---------	61	38	White spruce, red pine, Norway spruce, eastern white pine.
						Quaking aspen-------	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
						Northern red oak----	---	---	
						White oak-----------	---	---	
						American beech------	---	---	
110D------------ Negwegon	3L	Moderate	Moderate	Slight	Moderate	Sugar maple---------	62	39	White spruce, eastern white pine.
						Bigtooth aspen------	---	---	
						White ash-----------	---	---	
						Northern red oak----	---	---	
						Balsam fir----------	---	---	
						Eastern hemlock-----	---	---	
						American beech------	---	---	
110F------------ Negwegon	3R	Severe	Severe	Slight	Moderate	Sugar maple---------	62	39	White spruce, eastern white pine.
						Bigtooth aspen------	---	---	
						White ash-----------	---	---	
						Northern red oak----	---	---	
						Balsam fir----------	---	---	
						Eastern hemlock-----	---	---	
						American beech------	---	---	
111B------------ Manistee	3A	Slight	Slight	Slight	Slight	Sugar maple---------	67	41	Red pine, eastern white pine.
						Eastern white pine--	---	---	
						Red maple-----------	---	---	
						Red pine------------	---	---	
						American basswood---	---	---	
						Eastern hemlock-----	---	---	
						Northern red oak----	56	44	
						White ash-----------	---	---	
						Bigtooth aspen------	74	86	
209B------------ Grayling	4S	Slight	Moderate	Moderate	Slight	Jack pine-----------	48	63	Jack pine, red pine.
						Northern pin oak----	43	28	
						White oak-----------	---	---	
						Red pine------------	---	---	
						Quaking aspen-------	---	---	
210B, 210C------ Grayling	4S	Slight	Moderate	Moderate	Slight	Jack pine-----------	48	63	Jack pine, red pine.
						Northern pin oak----	43	28	
						White oak-----------	---	---	
						Red pine------------	---	---	
						Quaking aspen-------	---	---	
210D------------ Grayling	4R	Moderate	Moderate	Moderate	Slight	Jack pine-----------	48	63	Jack pine, red pine.
						Northern pin oak----	43	28	
						White oak-----------	---	---	
						Red pine------------	---	---	
						Quaking aspen-------	---	---	
211B, 211C------ Grayling	4S	Slight	Moderate	Moderate	Slight	Jack pine-----------	48	63	Jack pine, red pine.
						Northern pin oak----	43	28	
212B------------ Grayling	4S	Slight	Moderate	Moderate	Slight	Jack pine-----------	48	63	Jack pine, red pine.
						Northern pin oak----	43	28	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	Trees to plant
		Management concerns				Potential productivity			
213B, 213C------ Graycalm	6S	Slight	Moderate	Moderate	Slight	Bigtooth aspen------	70	81	Red pine, eastern white pine.
						Northern red oak----	62	54	
						Jack pine-----------	56	78	
						Red pine------------	61	104	
						Eastern white pine--	---	---	
						Quaking aspen-------	60	64	
215C, 220B, 220C Typic Udipsamments	---	Slight	Moderate	Moderate	Slight	---	---	---	---
220D------------ Typic Udipsamments	---	Moderate	Moderate	Moderate	Slight	---	---	---	---
220E------------ Typic Udipsamments	---	Severe	Severe	Moderate	Slight	---	---	---	---
221B, 221C------ Typic Udipsamments	---	Slight	Moderate	Moderate	Slight	---	---	---	---
221D------------ Typic Udipsamments	---	Moderate	Moderate	Moderate	Slight	---	---	---	---
222B------------ Typic Udipsamments	---	Slight	Moderate	Moderate	Slight	---	---	---	---
223B, 223C:									
Graycalm-------	6S	Slight	Moderate	Moderate	Slight	Bigtooth aspen------	70	81	Red pine, eastern white pine.
						Northern red oak----	62	54	
						Jack pine-----------	56	78	
						Red pine------------	61	104	
						Eastern white pine--	---	---	
						Quaking aspen-------	60	64	
Grayling-------	4S	Slight	Moderate	Moderate	Slight	Jack pine-----------	48	63	Jack pine, red pine.
						Northern pin oak----	43	28	
						White oak-----------	---	---	
						Red pine------------	---	---	
						Quaking aspen-------	---	---	
223D:									
Graycalm-------	6R	Slight	Moderate	Moderate	Slight	Bigtooth aspen------	70	81	Red pine, eastern white pine.
						Northern red oak----	62	54	
						Jack pine-----------	56	78	
						Red pine------------	61	104	
						Eastern white pine--	---	---	
						Quaking aspen-------	60	64	
Grayling-------	4R	Moderate	Moderate	Moderate	Slight	Jack pine-----------	48	63	Jack pine, red pine.
						Northern pin oak----	43	28	
						White oak-----------	---	---	
						Red pine------------	---	---	
						Quaking aspen-------	---	---	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
224B------------ Croswell	5S	Slight	Moderate	Moderate	Moderate	Quaking aspen-------	68	78	Red pine, eastern white pine, white spruce.
						Red pine------------	55	88	
						Jack pine-----------	53	73	
						Northern red oak----	---	---	
						Black cherry--------	---	---	
						Eastern white pine--	---	---	
						Bigtooth aspen------	69	80	
						Red maple-----------	---	---	
						Paper birch---------	54	55	
225B, 225C------ Entic Haplorthods	---	Slight	Moderate	Moderate	Slight	---	---	---	---
230C, 231B, 231C:									
Entic Haplorthods--	---	Slight	Moderate	Moderate	Slight	---	---	---	---
Alfic Haplorthods--	---	Slight	Slight	Slight	Slight	---	---	---	---
231D:									
Entic Haplorthods---	---	Moderate	Moderate	Moderate	Slight	---	---	---	---
Alfic Haplorthods---	---	Moderate	Moderate	Slight	Slight	---	---	---	---
232B:									
Entic Haplorthods---	---	Slight	Moderate	Moderate	Slight	---	---	---	---
Alfic Haplorthods---	---	Slight	Slight	Slight	Slight	---	---	---	---
233B, 233C:									
Alfic Haplorthods---	---	Slight	Slight	Slight	Slight	---	---	---	---
Entic Haplorthods---	---	Slight	Moderate	Moderate	Slight	---	---	---	---
233D:									
Alfic Haplorthods---	---	Moderate	Moderate	Slight	Slight	---	---	---	---
Entic Haplorthods---	---	Moderate	Moderate	Moderate	Slight	---	---	---	---

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
235B, 235C:									
Alfic Haplorthods, sandy over loamy	---	Slight	Moderate	Moderate	Slight	---	---	---	---
Alfic Haplorthods, sandy	---	Slight	Slight	Slight	Slight	---	---	---	---
235D:									
Alfic Haplorthods, sandy over loamy	---	Moderate	Moderate	Moderate	Slight	---	---	---	---
Alfic Haplorthods, sandy	---	Moderate	Moderate	Slight	Slight	---	---	---	---
247B, 247C:									
Glennie	5D	Slight	Moderate	Slight	Moderate	Northern red oak	72	69	White spruce, red pine, eastern white pine.
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Paper birch	---	---	
						American beech	---	---	
						Balsam fir	---	---	
						Eastern white pine	---	---	
						White ash	---	---	
Bamfield	3L	Slight	Moderate	Slight	Moderate	Sugar maple	61	38	White spruce, red pine, eastern white pine, Norway spruce.
						Northern red oak	---	---	
						Bigtooth aspen	---	---	
						American basswood	---	---	
						Paper birch	---	---	
						American beech	---	---	
						White ash	---	---	
						Eastern hemlock	---	---	
247D:									
Glennie	5R	Moderate	Moderate	Slight	Moderate	Northern red oak	72	69	White spruce, red pine, eastern white pine.
						Red maple	---	---	
						Bigtooth aspen	---	---	
						Paper birch	---	---	
						American beech	---	---	
						Balsam fir	---	---	
						Eastern white pine	---	---	
						White ash	---	---	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns: Erosion hazard	Management concerns: Equip- ment limita- tion	Management concerns: Seedling mortal- ity	Management concerns: Wind- throw hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
247D:									
Bamfield-------	3R	Moderate	Moderate	Slight	Slight	Sugar maple---------	61	38	Red pine, white spruce, eastern white pine, Norway spruce.
						Northern red oak----	---	---	
						Bigtooth aspen------	---	---	
						American basswood---	---	---	
						Paper birch---------	---	---	
						American beech------	---	---	
						White ash-----------	---	---	
						Eastern hemlock-----	---	---	
252A:									
Borosaprists.									
Au Gres--------	6W	Slight	Severe	Moderate	Severe	Quaking aspen-------	70	81	White spruce, red pine, eastern white pine, Norway spruce.
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
						Red maple-----------	65	40	
						Eastern white pine--	---	---	
						Northern whitecedar-	---	---	
						Jack pine-----------	51	69	
						Red pine------------	61	104	
253A:									
Au Gres--------	6W	Slight	Severe	Moderate	Severe	Quaking aspen-------	70	81	White spruce, red pine, eastern white pine, Norway spruce.
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
						Red maple-----------	65	40	
						Eastern white pine--	---	---	
						Northern whitecedar-	---	---	
						Jack pine-----------	51	69	
						Red pine------------	61	104	
Allendale------	4W	Slight	Severe	Moderate	Moderate	Quaking aspen-------	60	64	White spruce, eastern white pine.
						Black ash-----------	---	---	
						Eastern white pine--	---	---	
						White spruce--------	---	---	
						Paper birch---------	---	---	
						Balsam fir----------	---	---	
						Red maple-----------	---	---	
Croswell-------	5S	Slight	Moderate	Moderate	Moderate	Quaking aspen-------	68	78	Red pine, eastern white pine, white spruce.
						Red pine------------	55	88	
						Jack pine-----------	53	73	
						Northern red oak----	---	---	
						Black cherry--------	---	---	
						Eastern white pine--	---	---	
						Bigtooth aspen------	69	6	
						Red maple-----------	---	---	
						Paper birch---------	54	4	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
262A------------ Au Gres	6W	Slight	Severe	Moderate	Severe	Quaking aspen-------	70	81	White spruce, red pine, eastern white pine, Norway spruce.
						Bigtooth aspen------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	---	---	
						Red maple-----------	65	40	
						Eastern white pine--	---	---	
						Northern whitecedar-	---	---	
						Jack pine-----------	51	69	
						Red pine------------	61	104	
264A------------ Allendale	4W	Slight	Severe	Slight	Moderate	Quaking aspen-------	60	64	White spruce, eastern white pine.
						Black ash-----------	---	---	
						Eastern white pine--	---	---	
						White spruce--------	---	---	
						Paper birch---------	---	---	
						Balsam fir----------	---	---	
						Red maple-----------	---	---	
273:									
Leafriver------	2W	Slight	Severe	Severe	Severe	Quaking aspen-------	45	32	---
						Northern whitecedar-	---	---	
						Tamarack------------	---	---	
						Black spruce--------	---	---	
Wakeley--------	3W	Slight	Severe	Severe	Severe	Quaking aspen-------	50	43	Northern whitecedar.
						Black spruce--------	---	---	
						Balsam fir----------	---	---	
						Northern whitecedar-	---	---	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

Table 9.--Equipment Limitations on Woodland

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
11B: Eastport	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
12B:							
Tawas	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
16B: Graycalm	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Summer, fall, winter.	Slight	Slight	Slight.
16C, 16D: Graycalm	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
16E: Graycalm	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
17B: Croswell	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
18A: Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
19: Leafriver	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
26B: Croswell	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
27A: Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
28B: East Lake	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.

Table 9.--Equipment Limitations on Woodland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
28C East Lake	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
28E East Lake	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
29A Battlefield	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, fall, winter.	Slight	Slight	Slight.
30 Wheatley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
31B Klacking	Slight	Slight	Slight	Year round	Slight	Slight	Slight.
31C, 31D Klacking	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.	Slight.
31E Klacking	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
33B Mancelona	Slight	Slight	Slight	Year round	Slight	Slight	Slight.
33C, 33D Mancelona	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.	Slight.
33E Mancelona	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
35 Kinross	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
36B Alcona	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
36C Alcona	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
37A Richter	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.

Table 9.--Equipment Limitations on Woodland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
38 Tonkey	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
39B Glennie	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
39C Glennie	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
40A Sprinkler	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
41B McGinn	Slight	Slight	Slight	Year round	Slight	Slight	Slight.
41C, 41D McGinn	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.	Slight.
42A Killmaster	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
43 Wakeley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
44B Bamfield	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
45B Hoist	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
45C Hoist	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
46 Ensley	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
53B Negwegon	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.

Table 9.--Equipment Limitations on Woodland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
53C---------------- Negwegon	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight--------	Moderate: slope.	Slight.
54A---------------- Algonquin	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight--------	Slight--------	Slight.
55----------------- Springport	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight--------	Slight--------	Slight.
56B---------------- Nester	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight--------	Slight--------	Slight.
56C---------------- Nester	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight--------	Moderate: slope.	Slight.
57B---------------- Kawkawlin	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight--------	Slight--------	Slight.
59B:							
Algonquin---------	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight--------	Slight--------	Slight.
Springport--------	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight--------	Slight--------	Slight.
60D---------------- Glennie	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight--------	Moderate: slope.	Slight.
60E---------------- Glennie	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
61C, 61D---------- Manistee	Slight---------	Moderate: slope.	Slight--------	Year round-----	Slight--------	Moderate: slope.	Slight.
61F---------------- Manistee	Moderate*: slope.	Severe: slope.	Moderate*: slope.	Year round-----	Moderate*: slope.	Severe: slope.	Moderate*: slope.

See footnotes at end of table.

Table 9.--Equipment Limitations on Woodland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
62A---------------- Allendale	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
63C---------------- Bamfield	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.	Summer, fall, winter.	Slight--------	Moderate: slope.	Slight.
63D---------------- Bamfield	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight--------	Moderate: slope.	Slight.
63F---------------- Bamfield	Moderate*: slope, low strength.	Severe: slope.	Moderate*: slope, low strength.	Summer, fall, winter.	Moderate*: slope.	Severe: slope.	Moderate*: slope.
66D---------------- Alcona	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight--------	Moderate: slope.	Slight.
66E---------------- Alcona	Moderate: low strength, slope.	Severe: slope, low strength.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
68----------------- Rondeau	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
69----------------- Loxley	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
70----------------- Lupton	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
71----------------- Tawas	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
72----------------- Dorval	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.

See footnotes at end of table.

Table 9.--Equipment Limitations on Woodland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
73---------------- Markey	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
74C2-------------- Negwegon	Moderate: low strength.	Moderate: low strength, slope, too clayey.	Moderate: low strength, too clayey.	Summer, fall, winter.	Slight--------	Moderate: slope, too clayey.	Moderate: too clayey.
77---------------- Waucedah	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Slight--------	Slight--------	Slight.
80F:							
Zimmerman--------	Severe**: slope.	Severe: slope.	Severe**: slope.	Year round-----	Severe**: slope.	Severe: slope.	Severe**: slope.
Alcona-----------	Severe**: slope, low strength.	Severe: slope, low strength.	Severe**: slope, low strength.	Summer, fall, winter.	Severe**: slope.	Severe: slope.	Severe**: slope.
81B--------------- Grayling	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
81C--------------- Grayling	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.
81E--------------- Grayling	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
84B--------------- Zimmerman	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
84C, 84D---------- Zimmerman	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.
85B:							
Zimmerman--------	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
Alcona-----------	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight--------	Slight--------	Slight.

See footnotes at end of table.

Table 9.--Equipment Limitations on Woodland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
85D:							
Zimmerman	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Alcona	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
87 Ausable	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
88D Hoist	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
89F:							
Bamfield	Moderate*: low strength, slope.	Severe: slope.	Moderate*: low strength, slope.	Summer, fall, winter.	Moderate*: slope.	Severe: slope.	Moderate*: slope.
Lupton	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
90B Chinwhisker	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
91E:							
Glennie	Moderate: low strength, slope.	Severe: slope.	Moderate: low strength, slope.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Lupton	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
92B:							
Klacking	Slight	Slight	Slight	Year round	Slight	Slight	Slight.
McGinn	Slight	Slight	Slight	Year round	Slight	Slight	Slight.
93B:							
Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.

See footnotes at end of table.

Table 9.--Equipment Limitations on Woodland--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
93B:							
Wakeley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
94F:							
Klacking	Moderate*: slope.	Severe: slope.	Moderate*: slope.	Year round	Moderate*: slope.	Severe: slope.	Moderate*: slope.
McGinn	Moderate*: slope.	Severe: slope.	Moderate*: slope.	Year round	Moderate*: slope.	Severe: slope.	Moderate*: slope.
96D2 Negwegon	Moderate: low strength.	Moderate: slope, low strength, too clayey.	Moderate: low strength, too clayey.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
97 Colonville	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter	Slight	Slight	Slight.
98C Graycalm	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
102D Nester	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
102E Nester	Moderate: low strength, slope.	Severe: slope.	Moderate: low strength, slope.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
102F Nester	Moderate*: low strength, slope.	Severe: slope.	Moderate*: slope.	Summer, fall, winter.	Moderate*: slope.	Severe: slope.	Moderate*: slope.
110D Negwegon	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
110F Negwegon	Moderate*: slope.	Severe: slope.	Moderate*: slope.	Summer, fall, winter.	Moderate*: slope.	Severe: slope.	Moderate*: slope.
111B Manistee	Slight	Slight	Slight	Year round	Slight	Slight	Slight.

See footnotes at end of table.

Table 9.--Equipment Limitations on Woodland--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
209B, 210B-------- Grayling	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Summer, fall, winter.	Slight--------	Slight--------	Slight.
210C-------------- Grayling	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.
210D-------------- Grayling	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
211B-------------- Grayling	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Summer, fall, winter.	Slight--------	Slight--------	Slight.
211C-------------- Grayling	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.
212B-------------- Grayling	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Summer, fall, winter.	Slight--------	Slight--------	Slight.
213B-------------- Graycalm	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Summer, fall, winter.	Slight--------	Slight--------	Slight.
213C-------------- Graycalm	Moderate: too sandy.	Moderate: too sandy,	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.
215C-------------- Typic Udipsamments	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.
220B-------------- Typic Udipsamments	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
220C-------------- Typic Udipsamments	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.
220D-------------- Typic Udipsamments	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.

See footnotes at end of table.

Table 9.--Equipment Limitations on Woodland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
220E: Typic Udipsamments	Severe**: slope.	Severe: slope.	Severe**: slope.	Spring, fall, winter.	Severe**: slope.	Severe: slope.	Severe**: slope.
221B: Typic Udipsamments	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
221C: Typic Udipsamments	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
221D: Typic Udipsamments	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
222B: Typic Udipsamments	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
223B:							
Graycalm	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Grayling	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
223C:							
Graycalm	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Grayling	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
223D:							
Graycalm	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Grayling	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.

See footnotes at end of table.

Table 9.--Equipment Limitations on Woodland--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
224B: Croswell	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
225B: Entic Haplorthods	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
225C: Entic Haplorthods	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
230C:							
Entic Haplorthods	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Alfic Haplorthods	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
231B:							
Entic Haplorthods	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Alfic Haplorthods	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
231C:							
Entic Haplorthods	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Alfic Haplorthods	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
231D:							
Entic Haplorthods	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Alfic Haplorthods	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.

See footnotes at end of table.

Table 9.--Equipment Limitations on Woodland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
232B:							
Entic Haplorthods	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Alfic Haplorthods	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
233B:							
Alfic Haplorthods	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Entic Haplorthods	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
233C:							
Alfic Haplorthods	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Entic Haplorthods	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
233D:							
Alfic Haplorthods	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Entic Haplorthods	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
235B:							
Alfic Haplorthods, sandy over loamy	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
Alfic Haplorthods, sandy	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.

See footnotes at end of table.

Table 9.--Equipment Limitations on Woodland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
235C:							
Alfic Haplorthods, sandy over loamy	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
Alfic Haplorthods, sandy	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
235D:							
Alfic Haplorthods, sandy over loamy	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Alfic Haplorthods, sandy	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
247B:							
Glennie	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
Bamfield	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
247C:							
Glennie	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
Bamfield	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.

See footnotes at end of table.

Table 9.--Equipment Limitations on Woodland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
247D:							
Glennie----------	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Bamfield---------	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
252A:							
Borosaprists.							
Au Gres----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
253A:							
Au Gres----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
Allendale--------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
Croswell---------	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Summer, fall, winter.	Slight--------	Slight--------	Slight.
262A-------------- Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
264A-------------- Allendale	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
273:							
Leafriver--------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
Wakeley----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.

* Part of the soil may be rated severe.
** Part of the soil may be rated moderate.

Table 10.--Windbreaks and Environmental Plantings

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil or that the soil is entirely forested and planting is not likely)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
12B:				
Tawas	Black spruce, indigo silky dogwood, nannyberry viburnum, common ninebark, redosier dogwood, arrowwood.	Northern whitecedar, green ash.	---	---
Au Gres	American cranberrybush, Amur maple, common ninebark, nannyberry viburnum.	White spruce, jack pine, midwest Manchurian crabapple.	Norway spruce, green ash, eastern white pine.	Imperial Carolina poplar.
16B, 16C, 16D, 16E Graycalm	Siberian peashrub, lilac, eastern redcedar, Amur maple.	Red pine, jack pine	Eastern white pine	---
17B Croswell	Amur maple, lilac, eastern redcedar, Siberian peashrub.	Red pine, jack pine	Eastern white pine	---
18A Au Gres	American cranberrybush, Amur maple, common ninebark, nannyberry viburnum.	White spruce, jack pine, midwest Manchurian crabapple.	Norway spruce, green ash, eastern white pine.	Imperial Carolina poplar.
26B Croswell	Siberian peashrub, lilac, smooth sumac, eastern redcedar, staghorn sumac.	Eastern white pine, red pine, jack pine, midwest Manchurian crabapple, Austrian pine.	---	---
27A Au Gres	Indigo silky dogwood, American cranberrybush, lilac, nannyberry viburnum.	Siberian crabapple, white spruce, eastern redcedar.	Eastern white pine, green ash, jack pine, Norway spruce.	Imperial Carolina poplar.
28B, 28C, 28E East Lake	Siberian peashrub, Amur maple, eastern redcedar, lilac.	Red pine, jack pine	Eastern white pine	---
29A Battlefield	Northern whitecedar, indigo silky dogwood, American cranberrybush, common ninebark, nannyberry viburnum, Amur maple, lilac.	White spruce, Siberian crabapple.	Norway spruce, eastern white pine, green ash.	---

Table 10.--Windbreaks and Environmental Plantings--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
31B, 31C, 31D, 31E Klacking	Lilac, common ninebark, Roselow sargent crabapple, nannyberry viburnum, Amur maple.	White spruce, Siberian crabapple, eastern redcedar.	Norway spruce, eastern white pine, red pine.	Imperial Carolina poplar.
33B, 33C, 33D, 33E Mancelona	Amur maple, lilac, eastern redcedar, Siberian peashrub, northern whitecedar.	White spruce, jack pine, Manchurian crabapple, Norway spruce.	Red pine, eastern white pine.	Imperial Carolina poplar.
36B, 36C Alcona	Arrowwood, nannyberry viburnum, Siberian peashrub, American cranberrybush, lilac, indigo silky dogwood.	White spruce, Norway spruce, midwest Manchurian crabapple.	Eastern white pine, red pine.	Imperial Carolina poplar.
37A Richter	Northern whitecedar, American cranberrybush, indigo silky dogwood, lilac, nannyberry viburnum, common ninebark, Amur maple.	White spruce	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
38 Tonkey	Northern whitecedar, indigo silky dogwood, arrowwood, common ninebark, American cranberrybush, redosier dogwood.	White spruce, midwest Manchurian crabapple.	Norway spruce, eastern white pine, green ash, red maple.	---
39B, 39C Glennie	Lilac, nannyberry viburnum, Roselow sargent crabapple, Amur maple, indigo silky dogwood.	Norway spruce, red pine, midwest Manchurian crabapple, white spruce, eastern white pine.	Green ash	---
40A Sprinkler	American cranberrybush, lilac, Roselow sargent crabapple, Amur maple, indigo silky dogwood.	Norway spruce, red pine, midwest Manchurian crabapple, white spruce, eastern white pine.	Green ash	---
41B, 41C, 41D McGinn	Nannyberry viburnum, lilac, arrowwood, Siberian peashrub.	White spruce, Siberian crabapple, Austrian pine, eastern redcedar.	Red pine, eastern white pine, Norway spruce.	Imperial Carolina poplar.
42A Killmaster	American cranberrybush, redosier dogwood, northern whitecedar, lilac, indigo silky dogwood, Roselow sargent crabapple.	White spruce	Eastern white pine, white ash, red maple, Norway spruce.	Imperial Carolina poplar.

Table 10.--Windbreaks and Environmental Plantings--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
44B---------------Bamfield	Roselow sargent crabapple, northern whitecedar, lilac, Siberian peashrub, American cranberrybush.	Austrian pine, white spruce, blue spruce, midwest Manchurian crabapple.	Norway spruce, green ash.	Imperial Carolina poplar.
45B, 45C----------Hoist	Common ninebark, Amur maple, lilac, Roselow sargent crabapple, arrowwood.	Norway spruce, green ash, white spruce, midwest Manchurian crabapple.	Red pine, eastern white pine.	Imperial Carolina poplar.
46----------------Ensley	American cranberrybush, Roselow sargent crabapple, indigo silky dogwood, arrowwood, nannyberry viburnum, common ninebark.	White spruce, northern whitecedar.	Eastern white pine, green ash, red maple, Norway spruce.	---
53B, 53C----------Negwegon	Lilac, nannyberry viburnum, Roselow sargent crabapple, Amur maple, indigo silky dogwood, Siberian peashrub.	Midwest Manchurian crabapple, white spruce.	Norway spruce, red pine, green ash, eastern white pine.	---
54A---------------Algonquin	Lilac, Roselow sargent crabapple, indigo silky dogwood, American cranberrybush, Amur maple, Siberian peashrub.	White spruce, blue spruce, midwest Manchurian crabapple.	Norway spruce, eastern white pine, green ash.	---
55----------------Springport	American cranberrybush, lilac, Roselow sargent crabapple, Amur maple, indigo silky dogwood.	Norway spruce, red pine, midwest Manchurian crabapple, white spruce, eastern white pine.	Green ash-------------	---
56B, 56C----------Nester	Arrowwood, lilac, common ninebark, nannyberry viburnum, Siberian peashrub, indigo silky dogwood.	White spruce, blue spruce, midwest Manchurian crabapple.	Red pine, green ash, eastern white pine.	---
57B---------------Kawkawlin	Roselow sargent crabapple, indigo silky dogwood, Amur mample, lilac, American cranberrybush, nannyberry viburnum, northern whitecedar, common ninebark.	White spruce, red pine, Norway spruce, eastern white pine.	---	---

Table 10.--Windbreaks and Environmental Plantings--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
59B:				
Algonquin	Lilac, Roselow sargent crabapple, indigo silky dogwood, American cranberrybush, Amur maple, Siberian peashrub.	White spruce, blue spruce, midwest Manchurian crabapple.	Norway spruce, eastern white pine, green ash.	---
Springport	American cranberrybush, lilac, Roselow sargent crabapple, Amur maple, indigo silky dogwood.	Norway spruce, red pine, midwest Manchurian crabapple, white spruce, eastern white pine.	Green ash	---
60D, 60E: Glennie	Lilac, nannyberry viburnum, Roselow sargent crabapple, Amur maple, indigo silky dogwood.	Norway spruce, red pine, midwest Manchurian crabapple, white spruce, eastern white pine.	Green ash	---
61C, 61D, 61F: Manistee	Indigo silky dogwood, Amur maple, nannyberry viburnum, lilac, Amur privet, American cranberrybush.	White spruce, Siberian crabapple, eastern redcedar.	Red pine, Norway spruce, eastern white pine.	---
62A: Allendale	Northern whitecedar, American cranberrybush, Roselow sargent crabapple, lilac, nannyberry viburnum.	White spruce, midwest Manchurian crabapple, blue spruce.	Eastern white pine, red maple, Norway spruce.	---
63C, 63D, 63F: Bamfield	Roselow sargent crabapple, northern whitecedar, lilac, Siberian peashrub, American cranberrybush.	Austrian pine, white spruce, blue spruce, midwest Manchurian crabapple.	Norway spruce, green ash.	Imperial Carolina poplar.
66D, 66E: Alcona	Arrowwood, nannyberry viburnum, Siberian peashrub, American cranberrybush, lilac, indigo silky dogwood.	White spruce, Norway spruce, midwest Manchurian crabapple.	Eastern white pine, red pine.	Imperial Carolina poplar.
74C2: Negwegon	Lilac, nannyberry viburnum, Roselow sargent crabapple, Amur maple, indigo silky dogwood, Siberian peashrub.	Midwest Manchurian crabapple, white spruce.	Norway spruce, red pine, green ash, eastern white pine.	---
81B, 81C, 81E: Grayling	Lilac, silver buffaloberry, Siberian peashrub, smooth sumac, eastern redcedar, staghorn sumac.	Jack pine, eastern white pine, red pine.	---	---

Table 10.--Windbreaks and Environmental Plantings--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
84B, 84C, 84D----- Zimmerman	Eastern redcedar, Siberian crabapple, Amur privet, lilac, indigo silky dogwood, Amur maple, Siberian peashrub.	---	Red pine, eastern white pine, jack pine.	---
85B, 85D:				
Zimmerman--------	Eastern redcedar, Siberian crabapple, Amur privet, lilac, indigo silky dogwood, Amur maple, Siberian peashrub.	---	Red pine, eastern white pine, jack pine.	---
Alcona-----------	Arrowwood, nannyberry viburnum, Siberian peashrub, American cranberrybush, lilac, indigo silky dogwood.	White spruce, Norway spruce, midwest Manchurian crabapple.	Eastern white pine, red pine.	Imperial Carolina poplar.
88D-------------- Hoist	Common ninebark, Amur maple, lilac, Roselow sargent crabapple, arrowwood.	Norway spruce, green ash, white spruce, midwest Manchurian crabapple.	Red pine, eastern white pine.	Imperial Carolina poplar.
91E:				
Glennie----------	Lilac, nannyberry viburnum, Roselow sargent crabapple, Amur maple, indigo silky dogwood.	Norway spruce, red pine, midwest Manchurian crabapple, white spruce, eastern white pine.	Green ash-------------	---
Lupton.				
92B:				
Klacking---------	Lilac, common ninebark, Roselow sargent crabapple, nannyberry viburnum, Amur maple.	White spruce, Siberian crabapple, eastern redcedar.	Norway spruce, eastern white pine, red pine.	Imperial Carolina poplar.
McGinn-----------	Nannyberry viburnum, lilac, arrowwood, Siberian peashrub.	White spruce, Siberian crabapple, Austrian pine, eastern redcedar.	Red pine, eastern white pine, Norway spruce.	Imperial Carolina poplar.
93B:				
Au Gres----------	Silky dogwood, American cranberrybush, lilac, nannyberry viburnum.	Siberian crabapple, white spruce, eastern redcedar.	Eastern white pine, green ash, jack pine, Norway spruce.	Imperial Carolina poplar.
Wakeley.				
94F:				
Klacking---------	Lilac, common ninebark, Roselow sargent crabapple, nannyberry viburnum, Amur maple.	White spruce, Siberian crabapple, eastern redcedar.	Norway spruce, eastern white pine, red pine.	Imperial Carolina poplar.

Table 10.--Windbreaks and Environmental Plantings--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
94F:				
McGinn	Nannyberry viburnum, lilac, arrowwood, Siberian peashrub.	White spruce, Siberian crabapple, Austrian pine, eastern redcedar.	Red pine, eastern white pine, Norway spruce.	Imperial Carolina poplar.
96D2 Negwegon	Lilac, nannyberry viburnum, Roselow sargent crabapple, Amur maple, indigo silky dogwood, Siberian peashrub.	Midwest Manchurian crabapple, white spruce.	Norway spruce, red pine, green ash, eastern white pine.	---
97 Colonville	Nannyberry viburnum, Norway spruce, Siberian peashrub, Washington hawthorn, silver buffaloberry, staghorn sumac.	Lilac, blue spruce	Green ash	Imperial Carolina poplar.
98C Graycalm	Siberian peashrub, lilac, eastern redcedar, Amur maple.	Red pine, jack pine	Eastern white pine	---
102D, 102E, 102F Nester	Arrowwood, lilac, nannyberry viburnum, common ninebark, Siberian peashrub.	Blue spruce, white spruce, midwest Manchurian crabapple.	Red pine, green ash, eastern white pine.	---
110D, 110F Negwegon	Lilac, nannyberry viburnum, Roselow sargent crabapple, Amur maple, indigo silky dogwood, Siberian peashrub.	Midwest Manchurian crabapple, white spruce.	Norway spruce, red pine, green ash, eastern white pine.	---
111B Manistee	Indigo silky dogwood, Amur maple, eastern redcedar, Siberian peashrub, lilac, Roselow sargent crabapple, American cranberrybush.	White spruce, midwest Manchurian crabapple, Norway spruce.	Red pine, eastern white pine.	---

Table 11.--Recreational Development

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
11B: Eastport	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
12B:				
Tawas	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
Au Gres	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
16B: Graycalm	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
16C: Graycalm	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
16D: Graycalm	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
16E: Graycalm	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
17B: Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
18A: Au Gres	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
19: Leafriver	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
26B: Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
27A: Au Gres	Severe: wetness, too sandy.	Severe: too sandy.	Severe: too sandy, wetness.	Severe: too sandy.
28B: East Lake	Severe: too sandy.	Severe: too sandy.	Moderate: slope, small stones.	Severe: too sandy.
28C: East Lake	Severe: too sandy.	Severe: too sandy.	Severe: slope.	Severe: too sandy.
28E: East Lake	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.	Severe: too sandy.
29A: Battlefield	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
30-------------------- Wheatley	Severe: ponding, excess humus.	Severe: ponding.	Severe: ponding.	Severe: ponding.
31B------------------- Klacking	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.
31C------------------- Klacking	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
31D------------------- Klacking	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
31E------------------- Klacking	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
33B------------------- Mancelona	Slight---------------	Slight---------------	Moderate: slope, small stones.	Slight.
33C------------------- Mancelona	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
33D------------------- Mancelona	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
33E------------------- Mancelona	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
35-------------------- Kinross	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
36B------------------- Alcona	Slight---------------	Slight---------------	Moderate: slope.	Slight.
36C------------------- Alcona	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
37A------------------- Richter	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
38-------------------- Tonkey	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
39B------------------- Glennie	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight.
39C------------------- Glennie	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
40A------------------- Sprinkler	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
41B------------------- McGinn	Slight---------------	Slight---------------	Moderate: slope, small stones.	Slight.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
41C: McGinn	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
41D: McGinn	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
42A: Killmaster	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
43: Wakeley	Severe: ponding, percs slowly.	Severe: ponding, too sandy, percs slowly.	Severe: too sandy, ponding, percs slowly.	Severe: ponding, too sandy.
44B: Bamfield	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, small stones, wetness.	Moderate: wetness.
45B: Hoist	Slight	Slight	Moderate: slope, small stones.	Slight.
45C: Hoist	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
46: Ensley	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
53B: Negwegon	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.
53C: Negwegon	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.
54A: Algonquin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
55: Springport	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.
56B: Nester	Slight	Slight	Moderate: slope, small stones.	Slight.
56C: Nester	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
57B: Kawkawlin	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
59B:				
Algonquin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Springport	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
60D: Glennie	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
60E: Glennie	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
61C: Manistee	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight.
61D: Manistee	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Moderate: slope.
61F: Manistee	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope.
62A: Allendale	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.
63C: Bamfield	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
63D: Bamfield	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
63F: Bamfield	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
66D: Alcona	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
66E: Alcona	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
68: Rondeau	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
69: Loxley	Severe: ponding, excess humus, too acid.	Severe: ponding, excess humus, too acid.	Severe: excess humus, ponding, too acid.	Severe: ponding, excess humus.
70: Lupton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
71: Tawas	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
72: Dorval	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
73: Markey	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
74C2------------------ Negwegon	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.
77-------------------- Waucedah	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.
78. Pits				
80F:				
Zimmerman------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Alcona---------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
81B------------------- Grayling	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
81C------------------- Grayling	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
81E------------------- Grayling	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
82C------------------- Udorthents	Variable------------	Variable------------	Variable------------	Variable.
83F. Udipsamments				
84B------------------- Zimmerman	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
84C------------------- Zimmerman	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
84D------------------- Zimmerman	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
85B:				
Zimmerman------------	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Alcona---------------	Slight--------------	Slight--------------	Moderate: slope.	Slight.
85D:				
Zimmerman------------	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
85D:				
Alcona	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
86:				
Histosols.				
Aquents.				
87 Ausable	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.
88D Hoist	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
89F:				
Bamfield	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lupton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
90B Chinwhisker	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
91E:				
Glennie	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Lupton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
92B:				
Klacking	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.
McGinn	Slight	Slight	Moderate: slope, small stones.	Slight.
93B:				
Au Gres	Severe: wetness, too sandy.	Severe: too sandy.	Severe: too sandy, wetness.	Severe: too sandy.
Wakeley	Severe: ponding, percs slowly.	Severe: ponding, too sandy, percs slowly.	Severe: too sandy, ponding, percs slowly.	Severe: ponding, too sandy.
94F:				
Klacking	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
McGinn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
96D2------------------- Negwegon	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
97--------------------- Colonville	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
98C-------------------- Graycalm	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
102D, 102E------------ Nester	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
102F------------------ Nester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
110D------------------ Negwegon	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
110F------------------ Negwegon	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
111B------------------ Manistee	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight.
209B, 210B------------ Grayling	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
210C------------------ Grayling	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
210D------------------ Grayling	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
211B------------------ Grayling	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
211C------------------ Grayling	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
212B------------------ Grayling	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
213B------------------ Graycalm	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
213C------------------ Graycalm	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
215C------------------ Typic Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
220B------------------ Typic Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
220C------------------ Typic Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
220D------------------ Typic Udipsamments	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
220E------------------ Typic Udipsamments	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
221B------------------ Typic Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
221C------------------ Typic Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
221D------------------ Typic Udipsamments	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
222B------------------ Typic Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
223B:				
Graycalm-------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Grayling-------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
223C:				
Graycalm-------------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Grayling-------------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
223D:				
Graycalm-------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Grayling-------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
224B------------------ Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
225B------------------ Entic Haplorthods	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
225C------------------ Entic Haplorthods	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
230C:				
Entic Haplorthods----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Alfic Haplorthods----	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
231B:				
Entic Haplorthods----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Alfic Haplorthods----	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.
231C:				
Entic Haplorthods----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Alfic Haplorthods----	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
231D:				
Entic Haplorthods----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Alfic Haplorthods----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
232B:				
Entic Haplorthods----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Alfic Haplorthods----	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.
233B:				
Alfic Haplorthods----	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.
Entic Haplorthods----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
233C:				
Alfic Haplorthods----	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Entic Haplorthods----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
233D:				
Alfic Haplorthods	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Entic Haplorthods	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
235B:				
Alfic Haplorthods, sandy over loamy	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Alfic Haplorthods, sandy	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.
235C:				
Alfic Haplorthods, sandy over loamy	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Alfic Haplorthods, sandy	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
235D:				
Alfic Haplorthods, sandy over loamy	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Alfic Haplorthods, sandy	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
236B, 236C. Arenic Eutroboralfs				
237B, 237C, 237D. Glossic Eutroboralfs				
247B:				
Glennie	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight.
Bamfield	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, small stones, wetness.	Moderate: wetness.
247C:				
Glennie	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
247C:				
Bamfield	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
247D:				
Glennie	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Bamfield	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
250D:				
Glossic Eutroboralfs.				
Borosaprists.				
252A:				
Borosaprists.				
Au Gres	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
253A:				
Au Gres	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
Allendale	Severe: wetness, percs slowly, too sandy.	Severe: wetness, too sandy, percs slowly.	Severe: too sandy, wetness, percs slowly.	Severe: wetness, too sandy.
Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
262A Au Gres	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
263A. Alfic Haplaquods				
264A Allendale	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.
272:				
Haplaquods.				
Fluvaquents.				
273:				
Leafriver	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
Wakeley	Severe: ponding, percs slowly.	Severe: ponding, too sandy, percs slowly.	Severe: too sandy, ponding, percs slowly.	Severe: ponding, too sandy.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
274. Typic Haplaquods				
280:				
Aquents.				
Histosols.				
281, 282. Borosaprists				

Table 12.--Wildlife Habitat

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
11B: Eastport	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
12B:										
Tawas	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
16B, 16C, 16D: Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
16E: Graycalm	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
17B: Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
18A: Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
19: Leafriver	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
26B: Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
27A: Au Gres	Poor	Fair	Good	Good	Good	Poor	Fair	Fair	Good	Poor.
28B: East Lake	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
28C: East Lake	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
28E: East Lake	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
29A: Battlefield	Fair	Fair	Good	Fair	Fair	Fair	Poor	Fair	Fair	Poor.
30: Wheatley	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
31B: Klacking	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
31C: Klacking	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
31D, 31E: Klacking	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
33B, 33C: Mancelona	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
33D: Mancelona	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

Table 12.--Wildlife Habitat--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
33E---------------- Mancelona	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
35----------------- Kinross	Very poor.	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Fair	Good.
36B, 36C----------- Alcona	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
37A---------------- Richter	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
38----------------- Tonkey	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
39B---------------- Glennie	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Very poor.
39C---------------- Glennie	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
40A---------------- Sprinkler	Fair	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
41B, 41C----------- McGinn	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
41D---------------- McGinn	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
42A---------------- Killmaster	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
43----------------- Wakeley	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
44B---------------- Bamfield	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
45B---------------- Hoist	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
45C---------------- Hoist	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
46----------------- Ensley	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
53B---------------- Negwegon	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
53C---------------- Negwegon	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
54A---------------- Algonquin	Fair	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.
55----------------- Springport	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.

Table 12.--Wildlife Habitat--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
56B, 56C----------- Nester	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
57B---------------- Kawkawlin	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
59B:										
Algonquin---------	Good	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
Springport--------	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
60D---------------- Glennie	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
60E---------------- Glennie	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
61C---------------- Manistee	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
61D---------------- Manistee	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
61F---------------- Manistee	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
62A---------------- Allendale	Fair	Fair	Good	Good	Good	Poor	Fair	Fair	Good	Poor.
63C---------------- Bamfield	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
63D---------------- Bamfield	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
63F---------------- Bamfield	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
66D, 66E----------- Alcona	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
68----------------- Rondeau	Poor	Poor	Poor	Very poor.	Very poor.	Good	Good	Poor	Very poor.	Good.
69----------------- Loxley	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
70----------------- Lupton	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
71----------------- Tawas	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
72----------------- Dorval	Very poor.	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Poor	Good.
73----------------- Markey	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
74C2--------------- Negwegon	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

Table 12.--Wildlife Habitat--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
77------------------ Waucedah	Very poor.	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good.
78. Pits										
80F:										
Zimmerman---------	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Alcona------------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
81B---------------- Grayling	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
81C, 81E----------- Grayling	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
82C. Udorthents										
83F. Udipsamments										
84B, 84C, 84D------ Zimmerman	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
85B, 85D:										
Zimmerman---------	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Alcona------------	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
86:										
Histosols.										
Aquents.										
87----------------- Ausable	Very poor.	Poor	Poor	Poor	Poor	Fair	Good	Poor	Poor	Fair.
88D---------------- Hoist	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
89F:										
Bamfield----------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Lupton------------	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
90B---------------- Chinwhisker	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
91E:										
Glennie-----------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Lupton------------	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.

Table 12.--Wildlife Habitat--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
92B:										
Klacking----------	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
McGinn------------	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
93B:										
Au Gres-----------	Poor	Fair	Good	Good	Good	Poor	Fair	Fair	Good	Poor.
Wakeley-----------	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
94F:										
Klacking----------	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
McGinn------------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
96D2--------------- Negwegon	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
97----------------- Colonville	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
98C---------------- Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
102D, 102E--------- Nester	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
102F--------------- Nester	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
110D--------------- Negwegon	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
110F--------------- Negwegon	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
111B--------------- Manistee	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
209B--------------- Grayling	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
210B--------------- Grayling	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
210C, 210D, 211B--- Grayling	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
211C--------------- Grayling	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
212B--------------- Grayling	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
213B, 213C--------- Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

Table 12.--Wildlife Habitat--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
215C---------------- Typic Udipsamments	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
220B---------------- Typic Udipsamments	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
220C, 220D, 220E--- Typic Udipsamments	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
221B---------------- Typic Udipsamments	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
221C, 221D--------- Typic Udipsamments	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
222B---------------- Typic Udipsamments	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
223B:										
Graycalm----------	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Grayling----------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
223C, 223D:										
Graycalm----------	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Grayling----------	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
224B---------------- Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
225B---------------- Entic Haplorthods	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
225C---------------- Entic Haplorthods	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
230C:										
Entic Haplorthods-	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Alfic Haplorthods-	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
231B:										
Entic Haplorthods-	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Alfic Haplorthods-	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
231C, 231D:										
Entic Haplorthods-	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Alfic Haplorthods-	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

Table 12.--Wildlife Habitat--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
232B:										
Entic Haplorthods	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Alfic Haplorthods	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
233B:										
Alfic Haplorthods	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Entic Haplorthods	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
233C, 233D:										
Alfic Haplorthods	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Entic Haplorthods	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
235B:										
Alfic Haplorthods, sandy over loamy	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Alfic Haplorthods, sandy	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
235C, 235D:										
Alfic Haplorthods, sandy over loamy	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Alfic Haplorthods, sandy	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
236B, 236C. Arenic Eutroboralfs										
237B, 237C, 237D. Glossic Eutroboralfs										
247B:										
Glennie	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Very poor.
Bamfield	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
247C:										
Glennie	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Bamfield	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

Table 12.--Wildlife Habitat--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
247D:										
Glennie	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Bamfield	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
250D:										
Glossic Eutroboralfs.										
Borosaprists.										
252A:										
Borosaprists.										
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
253A:										
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
Allendale	Fair	Fair	Good	Good	Good	Poor	Fair	Fair	Good	Poor.
Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
262A Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
263A. Alfic Haplaquods										
264A Allendale	Fair	Fair	Good	Good	Good	Poor	Fair	Fair	Good	Poor.
272:										
Haplaquods.										
Fluvaquents.										
273:										
Leafriver	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Wakeley	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
274. Typic Haplaquods										
280:										
Aquents.										
Histosols.										
281, 282. Borosaprists.										

Table 13.--Building Site Development

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
11B: Eastport	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
12B:						
Tawas	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
16B: Graycalm	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
16C: Graycalm	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
16D, 16E: Graycalm	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
17B: Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
18A: Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
19: Leafriver	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
26B: Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
27A: Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty, too sandy.
28B: East Lake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: large stones, droughty.
28C: East Lake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.

Table 13.--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
28E---------------- East Lake	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
29A---------------- Battlefield	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
30----------------- Wheatley	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, excess humus.
31B---------------- Klacking	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
31C---------------- Klacking	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
31D, 31E----------- Klacking	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
33B---------------- Mancelona	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: large stones, droughty.
33C---------------- Mancelona	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.
33D, 33E----------- Mancelona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
35----------------- Kinross	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, excess humus.
36B---------------- Alcona	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Moderate: large stones, droughty.
36C---------------- Alcona	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
37A---------------- Richter	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
38----------------- Tonkey	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
39B---------------- Glennie	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Moderate: large stones, droughty.

Table 13.--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
39C--------------- Glennie	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
40A--------------- Sprinkler	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
41B--------------- McGinn	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: large stones.
41C--------------- McGinn	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, slope.
41D--------------- McGinn	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
42A--------------- Killmaster	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: large stones, wetness, droughty.
43---------------- Wakeley	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding.	Severe: ponding.
44B--------------- Bamfield	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
45B--------------- Hoist	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Moderate: large stones.
45C--------------- Hoist	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, slope.
46---------------- Ensley	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
53B--------------- Negwegon	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
53C--------------- Negwegon	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
54A--------------- Algonquin	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
55---------------- Springport	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.

Table 13.--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
56B--------------- Nester	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
56C--------------- Nester	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
57B--------------- Kawkawlin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
59B:						
Algonquin--------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
Springport-------	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
60D, 60E---------- Glennie	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
61C--------------- Manistee	Severe: cutbanks cave.	Moderate: slope.	Severe: shrink-swell.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
61D, 61F---------- Manistee	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope.	Severe: slope.	Severe: slope.
62A--------------- Allendale	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness.	Severe: wetness.
63C--------------- Bamfield	Moderate: dense layer, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
63D, 63F---------- Bamfield	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
66D, 66E---------- Alcona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
68---------------- Rondeau	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: ponding, excess humus.
69---------------- Loxley	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: too acid, ponding, excess humus.

Table 13.--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
70 Lupton	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
71 Tawas	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
72 Dorval	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, shrink-swell.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
73 Markey	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
74C2 Negwegon	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
77 Waucedah	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding, frost action.	Severe: ponding, flooding, excess humus.
78. Pits						
80F:						
Zimmerman	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Alcona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
81B Grayling	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
81C Grayling	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
81E Grayling	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
82C Udorthents	Variable	Variable	Variable	Variable	Variable	Variable.
83F. Udipsamments						
84B Zimmerman	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.

Table 13.--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
84C---------------- Zimmerman	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
84D---------------- Zimmerman	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
85B:						
Zimmerman--------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
Alcona-----------	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Moderate: large stones, droughty.
85D:						
Zimmerman--------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Alcona-----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
86:						
Histosols.						
Aquents.					frost action.	
87---------------- Ausable	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: ponding, flooding, excess humus.
88D---------------- Hoist	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
89F:						
Bamfield---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Lupton-----------	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
90B---------------- Chinwhisker	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
91E:						
Glennie----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lupton-----------	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.

Table 13.--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
92B:						
Klacking	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
McGinn	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: large stones.
93B:						
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty, too sandy.
Wakeley	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding.	Severe: ponding.
94F:						
Klacking	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
McGinn	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
96D2 Negwegon	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
97 Colonville	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, droughty, flooding.
98C Graycalm	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
102D, 102E, 102F Nester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
110D, 110F Negwegon	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
111B Manistee	Severe: cutbanks cave.	Slight	Severe: shrink-swell.	Slight	Slight	Moderate: droughty.
209B, 210B Grayling	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
210C Grayling	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
210D Grayling	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
211B Grayling	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.

Table 13.--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
211C-------------- Grayling	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
212B-------------- Grayling	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty, too sandy.
213B-------------- Graycalm	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
213C-------------- Graycalm	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
215C-------------- Typic Udipsamments	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
220B-------------- Typic Udipsamments	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty, too sandy.
220C-------------- Typic Udipsamments	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
220D, 220E-------- Typic Udipsamments	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
221B-------------- Typic Udipsamments	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty, too sandy.
221C-------------- Typic Udipsamments	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
221D-------------- Typic Udipsamments	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
222B-------------- Typic Udipsamments	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Moderate: droughty, too sandy.
223B:						
Graycalm---------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
Grayling---------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
223C:						
Graycalm---------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Grayling---------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.

Table 13.--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
223D:						
Graycalm	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Grayling	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
224B Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
225B Entic Haplorthods	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
225C Entic Haplorthods	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
230C:						
Entic Haplorthods	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
Alfic Haplorthods	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
231B:						
Entic Haplorthods	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
Alfic Haplorthods	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
231C:						
Entic Haplorthods	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
Alfic Haplorthods	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
231D:						
Entic Haplorthods	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Alfic Haplorthods	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
232B:						
Entic Haplorthods	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Moderate: droughty, too sandy.

Table 13.--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
232B:						
Alfic Haplorthods	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
233B:						
Alfic Haplorthods	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Entic Haplorthods	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
233C:						
Alfic Haplorthods	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Entic Haplorthods	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
233D:						
Alfic Haplorthods	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Entic Haplorthods	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
235B:						
Alfic Haplorthods, sandy over loamy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
Alfic Haplorthods, sandy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
235C:						
Alfic Haplorthods, sandy over loamy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
Alfic Haplorthods, sandy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
235D:						
Alfic Haplorthods, sandy over loamy	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Table 13.--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
235D:						
Alfic Haplorthods, sandy-----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
236B, 236C. Arenic Eutroboralfs						
237B, 237C, 237D. Glossic Eutroboralfs						
247B:						
Glennie----------	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Moderate: large stones, droughty.
Bamfield---------	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
247C:						
Glennie----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
Bamfield---------	Moderate: dense layer, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
247D:						
Glennie----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bamfield---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
250D:						
Glossic Eutroboralfs.						
Borosaprists.						
252A:						
Borosaprists.						
Au Gres----------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
253A:						
Au Gres----------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

Table 13.--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
253A:						
Allendale	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
262A Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
263A. Alfic Haplaquods						
264A Allendale	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness.	Severe: wetness.
272:						
Haplaquods.						
Fluvaquents.						
273:						
Leafriver	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
Wakeley	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding.	Severe: ponding.
274. Typic Haplaquods						
280:						
Aquents.						
Histosols.						
281, 282. Borosaprists.						

Table 14.--Sanitary Facilities

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
11B: Eastport	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
12B:					
Tawas	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
16B: Graycalm	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
16C: Graycalm	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
16D, 16E: Graycalm	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
17B: Croswell	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
18A: Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
19: Leafriver	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
26B: Croswell	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
27A: Au Gres	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
28B: East Lake	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

Table 14.--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
28C-----------------East Lake	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
28E-----------------East Lake	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
29A-----------------Battlefield	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
30------------------Wheatley	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, small stones.
31B-----------------Klacking	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
31C-----------------Klacking	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
31D, 31E------------Klacking	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
33B-----------------Mancelona	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
33C-----------------Mancelona	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
33D, 33E------------Mancelona	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
35------------------Kinross	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
36B-----------------Alcona	Severe: wetness.	Severe: seepage, wetness.	Severe: too sandy.	Moderate: wetness.	Poor: too sandy.
36C-----------------Alcona	Severe: wetness.	Severe: seepage, slope, wetness.	Severe: too sandy.	Moderate: wetness, slope.	Poor: too sandy.

Table 14.--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
37A----------------- Richter	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
38------------------ Tonkey	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
39B----------------- Glennie	Severe: wetness, percs slowly.	Severe: seepage.	Moderate: wetness, too sandy.	Slight-----------	Poor: thin layer.
39C----------------- Glennie	Severe: wetness, percs slowly.	Severe: seepage, slope.	Moderate: wetness, slope, too sandy.	Moderate: slope.	Poor: thin layer.
40A----------------- Sprinkler	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
41B----------------- McGinn	Moderate: percs slowly.	Severe: seepage.	Slight-----------	Severe: seepage.	Good.
41C----------------- McGinn	Moderate: percs slowly, slope.	Severe: seepage, slope.	Moderate: slope.	Severe: seepage.	Fair: slope.
41D----------------- McGinn	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: slope.
42A----------------- Killmaster	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
43------------------ Wakeley	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: ponding, too clayey.	Severe: seepage, ponding.	Poor: too clayey, hard to pack, ponding.
44B----------------- Bamfield	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
45B----------------- Hoist	Severe: wetness, percs slowly.	Severe: seepage.	Moderate: wetness.	Severe: seepage.	Fair: wetness.
45C----------------- Hoist	Severe: wetness, percs slowly.	Severe: seepage, slope.	Moderate: wetness, slope.	Severe: seepage.	Fair: slope, wetness.
46------------------ Ensley	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
53B----------------- Negwegon	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.

Table 14.--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
53C----------------- Negwegon	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
54A----------------- Algonquin	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
55------------------ Springport	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
56B----------------- Nester	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, small stones.
56C----------------- Nester	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Fair: too clayey, small stones, slope.
57B----------------- Kawkawlin	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
59B:					
Algonquin----------	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Springport---------	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
60D, 60E------------ Glennie	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope, thin layer.
61C----------------- Manistee	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
61D, 61F------------ Manistee	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too clayey.	Severe: seepage, slope.	Poor: too clayey, hard to pack, slope.
62A----------------- Allendale	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
63C----------------- Bamfield	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.

Table 14.--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
63D, 63F------------ Bamfield	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
66D, 66E------------ Alcona	Severe: slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: too sandy, slope.
68------------------ Rondeau	Severe: subsides, ponding.	Severe: seepage, excess humus.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
69------------------ Loxley	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus, too acid.
70------------------ Lupton	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
71------------------ Tawas	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
72------------------ Dorval	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, too clayey.	Severe: seepage, ponding.	Poor: too clayey, hard to pack, ponding.
73------------------ Markey	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
74C2---------------- Negwegon	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
77------------------ Waucedah	Severe: flooding, ponding, percs slowly.	Severe: flooding, excess humus, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.
78. Pits					
80F:					
Zimmerman----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Alcona-------------	Severe: slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: too sandy, slope.
81B----------------- Grayling	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

Table 14.--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
81C: Grayling	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
81E: Grayling	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
82C: Udorthents	Variable	Variable	Variable	Variable	Variable.
83F. Udipsamments					
84B: Zimmerman	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
84C: Zimmerman	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
84D: Zimmerman	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
85B:					
Zimmerman	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Alcona	Severe: wetness.	Severe: seepage, wetness.	Severe: too sandy.	Moderate: wetness.	Poor: too sandy.
85D:					
Zimmerman	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Alcona	Severe: wetness.	Severe: seepage, slope, wetness.	Severe: too sandy.	Moderate: wetness, slope.	Poor: too sandy.
86:					
Histosols.					
Aquents.					
87: Ausable	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding, excess humus.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, ponding.
88D: Hoist	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: slope.

Table 14.--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
89F:					
Bamfield	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Lupton	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
90B Chinwhisker	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
91E:					
Glennie	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope, thin layer.
Lupton	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
92B:					
Klacking	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
McGinn	Moderate: percs slowly.	Severe: seepage.	Slight	Severe: seepage.	Good.
93B:					
Au Gres	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Wakeley	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: ponding, too clayey.	Severe: seepage, ponding.	Poor: too clayey, hard to pack, ponding.
94F:					
Klacking	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
McGinn	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: slope.
96D2 Negwegon	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.

Table 14.--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
97------------------ Colonville	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: too sandy, wetness.
98C----------------- Graycalm	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
102D, 102E, 102F---- Nester	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
110D, 110F---------- Negwegon	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
111B---------------- Manistee	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
209B, 210B---------- Grayling	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
210C---------------- Grayling	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
210D---------------- Grayling	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
211B---------------- Grayling	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
211C---------------- Grayling	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
212B---------------- Grayling	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
213B---------------- Graycalm	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
213C---------------- Graycalm	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
215C---------------- Typic Udipsamments	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.

Table 14.--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
220B---------------- Typic Udipsamments	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
220C---------------- Typic Udipsamments	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
220D, 220E---------- Typic Udipsamments	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
221B---------------- Typic Udipsamments	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
221C---------------- Typic Udipsamments	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
221D---------------- Typic Udipsamments	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
222B---------------- Typic Udipsamments	Severe: poor filter.	Severe: seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
223B:					
Graycalm-----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Grayling-----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
223C:					
Graycalm-----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Grayling-----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
223D:					
Graycalm-----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Grayling-----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.

Table 14.--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
224B----------------Croswell	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
225B----------------Entic Haplorthods	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
225C----------------Entic Haplorthods	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
230C:					
Entic Haplorthods--	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Alfic Haplorthods--	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
231B:					
Entic Haplorthods--	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Alfic Haplorthods--	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
231C:					
Entic Haplorthods--	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Alfic Haplorthods--	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
231D:					
Entic Haplorthods--	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Alfic Haplorthods--	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
232B:					
Entic Haplorthods--	Severe: poor filter.	Severe: seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Alfic Haplorthods--	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

Table 14.--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
233B:					
Alfic Haplorthods--	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Entic Haplorthods--	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
233C:					
Alfic Haplorthods--	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Entic Haplorthods--	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
233D:					
Alfic Haplorthods--	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Entic Haplorthods--	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
235B:					
Alfic Haplorthods, sandy over loamy--	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Alfic Haplorthods, sandy-------------	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
235C:					
Alfic Haplorthods, sandy over loamy--	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Alfic Haplorthods, sandy-------------	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
235D:					
Alfic Haplorthods, sandy over loamy--	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Alfic Haplorthods, sandy-------------	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.

Table 14.--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
236B, 236C. Arenic Eutroboralfs					
237B, 237C, 237D. Glossic Eutroboralfs					
247B:					
Glennie	Severe: wetness, percs slowly.	Severe: seepage.	Moderate: wetness, too sandy.	Slight	Poor: thin layer.
Bamfield	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
247C:					
Glennie	Severe: wetness, percs slowly.	Severe: seepage, slope.	Moderate: wetness, slope, too sandy.	Moderate: slope.	Poor: thin layer.
Bamfield	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
247D:					
Glennie	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope, thin layer.
Bamfield	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
250D:					
Glossic Eutroboralfs.					
Borosaprists.					
252A:					
Borosaprists.					
Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
253A:					
Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Allendale	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.

Table 14.--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
253A:					
Croswell-----------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
262A---------------- Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
263A. Alfic Haplaquods					
264A---------------- Allendale	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
272:					
Haplaquods.					
Fluvaquents.					
273:					
Leafriver----------	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor seepage, too sandy, ponding.
Wakeley------------	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: ponding, too clayey.	Severe: seepage, ponding.	Poor: too clayey, hard to pack, ponding.
274. Typic Haplaquods					
280:					
Aquents.					
Histosols.					
281, 282. Borosaprists					

Table 15.--Construction Materials

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
11B: Eastport	Good	Probable	Improbable: too sandy.	Poor: too sandy.
12B:				
Tawas	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
16B, 16C: Graycalm	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
16D: Graycalm	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
16E: Graycalm	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
17B: Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
18A: Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
19: Leafriver	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
26B: Croswell	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
27A: Au Gres	Fair: thin layer, wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
28B, 28C: East Lake	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
28E: East Lake	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
29A: Battlefield	Poor: wetness.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
30: Wheatley	Poor: wetness.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
31B, 31C: Klacking	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
31D: Klacking	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
31E: Klacking	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
33B, 33C: Mancelona	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
33D: Mancelona	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
33E: Mancelona	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
35: Kinross	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
36B, 36C: Alcona	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
37A: Richter	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
38: Tonkey	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
39B, 39C: Glennie	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too sandy, small stones.
40A: Sprinkler	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
41B------------------- McGinn	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
41C------------------- McGinn	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, slope.
41D------------------- McGinn	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
42A------------------- Killmaster	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too sandy, small stones.
43-------------------- Wakeley	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
44B------------------- Bamfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, small stones.
45B------------------- Hoist	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
45C------------------- Hoist	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
46-------------------- Ensley	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
53B, 53C-------------- Negwegon	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
54A------------------- Algonquin	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
55-------------------- Springport	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
56B, 56C-------------- Nester	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
57B------------------- Kawkawlin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
59B:				
Algonquin	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Springport	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
60D Glennie	Fair: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
60E Glennie	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
61C Manistee	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
61D Manistee	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
61F Manistee	Poor: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
62A Allendale	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
63C Bamfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, slope.
63D Bamfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
63F Bamfield	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
66D Alcona	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
66E Alcona	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
68 Rondeau	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
69 Loxley	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness, too acid.
70 Lupton	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
71 Tawas	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
72 Dorval	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
73 Markey	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
74C2 Negwegon	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
77 Waucedah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
78. Pits				
80F:				
Zimmerman	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Alcona	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
81B, 81C Grayling	Good	Probable	Improbable: too sandy.	Poor: too sandy.
81E Grayling	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
82C Udorthents	Variable	Variable	Variable	Variable.
83F. Udipsamments				
84B, 84C Zimmerman	Good	Probable	Improbable: too sandy.	Poor: too sandy.
84D Zimmerman	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
85B, 85D:				
Zimmerman	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Alcona	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
86:				
Histosols.				
Aquents.				
87 Ausable	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, wetness.
88D Hoist	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
89F:				
Bamfield	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Lupton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
90B Chinwhisker	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
91E:				
Glennie	Fair: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Lupton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
92B:				
Klacking	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
McGinn	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
93B:				
Au Gres	Fair: thin layer, wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
Wakeley	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
94F:				
Klacking	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
McGinn	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
96D2 Negwegon	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
97 Colonville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
98C Graycalm	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
102D, 102E Nester	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
102F Nester	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
110D Negwegon	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
110F Negwegon	Poor: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
111B Manistee	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
209B, 210B, 210C Grayling	Good	Probable	Improbable: too sandy.	Poor: too sandy.
210D Grayling	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
211B, 211C, 212B Grayling	Good	Probable	Improbable: too sandy.	Poor: too sandy.
213B, 213C Graycalm	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
215C, 220B, 220C Typic Udipsamments	Good	Probable	Improbable: too sandy.	Poor: too sandy.
220D Typic Udipsamments	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
220E------------------ Typic Udipsamments	Poor: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.
221B, 221C------------ Typic Udipsamments	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
221D------------------ Typic Udipsamments	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.
222B------------------ Typic Udipsamments	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
223B, 223C:				
Graycalm-------------	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy, small stones.
Grayling-------------	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
223D:				
Graycalm-------------	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, small stones, slope.
Grayling-------------	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.
224B------------------ Croswell	Fair: wetness.	Probable-------------	Improbable: too sandy.	Poor: too sandy.
225B, 225C------------ Entic Haplorthods	Good-----------------	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
230C, 231B, 231C:				
Entic Haplorthods----	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
Alfic Haplorthods----	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
231D:				
Entic Haplorthods----	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.
Alfic Haplorthods----	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.
232B:				
Entic Haplorthods----	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
Alfic Haplorthods----	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
233B, 233C:				
Alfic Haplorthods	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Entic Haplorthods	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
233D:				
Alfic Haplorthods	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Entic Haplorthods	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
235B, 235C:				
Alfic Haplorthods, sandy over loamy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Alfic Haplorthods, sandy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
235D:				
Alfic Haplorthods, sandy over loamy	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Alfic Haplorthods, sandy	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
236B, 236C. Arenic Eutroboralfs				
237B, 237C, 237D. Glossic Eutroboralfs				
247B:				
Glennie	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too sandy, small stones.
Bamfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, small stones.
247C:				
Glennie	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too sandy, small stones.
Bamfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, slope.

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
247D:				
Glennie	Fair: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Bamfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
250D:				
Glossic Eutroboralfs.				
Borosaprists.				
252A:				
Borosaprists.				
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
253A:				
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Allendale	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
262A Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
263A. Alfic Haplaquods				
264A Allendale	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
272:				
Haplaquods.				
Fluvaquents.				
273:				
Leafriver	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Wakeley	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
274.				
Typic Haplaquods.				

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
280:				
Aquents.				
Histosols.				
281, 282. Borosaprists.				

Table 16.--Water Management

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
11B--------------- Eastport	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
12B:						
Tawas------------	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
Au Gres----------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
16B--------------- Graycalm	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
16C, 16D, 16E----- Graycalm	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
17B--------------- Croswell	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Slope, cutbanks cave.	Slope, wetness, droughty.	Droughty.
18A--------------- Au Gres	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
19---------------- Leafriver	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
26B--------------- Croswell	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Slope, cutbanks cave.	Slope, wetness, droughty.	Droughty, rooting depth.
27A--------------- Au Gres	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
28B--------------- East Lake	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
28C, 28E---------- East Lake	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
29A: Battlefield	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, droughty.
30: Wheatley	Severe: seepage.	Severe: seepage, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty.	Wetness, droughty.
31B: Klacking	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
31C, 31D, 31E: Klacking	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
33B: Mancelona	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
33C, 33D, 33E: Mancelona	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
35: Kinross	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding	Wetness.
36B: Alcona	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Slope, cutbanks cave.	Slope, wetness, droughty.	Droughty.
36C: Alcona	Severe: slope.	Severe: piping.	Severe: no water.	Slope, cutbanks cave.	Slope, wetness, droughty.	Slope, droughty.
37A: Richter	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, droughty.	Wetness, droughty.
38: Tonkey	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding	Wetness, rooting depth.
39B: Glennie	Moderate: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, droughty.
39C: Glennie	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
40A: Sprinkler	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Frost action	Wetness, droughty, soil blowing.	Wetness, erodes easily, droughty.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
41B---------------McGinn	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Rooting depth.
41C, 41D----------McGinn	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Slope, rooting depth.
42A---------------Killmaster	Severe: seepage.	Severe: piping.	Severe: no water.	Percs slowly, frost action.	Wetness, droughty, soil blowing.	Wetness, droughty, rooting depth.
43----------------Wakeley	Severe: seepage.	Severe: ponding.	Severe: no water.	Ponding, percs slowly.	Ponding, droughty, fast intake.	Wetness, droughty, percs slowly.
44B---------------Bamfield	Moderate: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, soil blowing.	Erodes easily, rooting depth, percs slowly.
45B---------------Hoist	Severe: seepage.	Severe: piping.	Severe: no water.	Slope----------	Slope, wetness, soil blowing.	Rooting depth.
45C---------------Hoist	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Slope----------	Slope, wetness, soil blowing.	Slope, rooting depth.
46----------------Ensley	Severe: seepage.	Severe: seepage, piping, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding--------	Wetness.
53B---------------Negwegon	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Wetness, erodes easily.
53C---------------Negwegon	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Wetness, slope, erodes easily.
54A---------------Algonquin	Slight---------	Severe: wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, erodes easily, percs slowly.
55----------------Springport	Slight---------	Severe: ponding.	Severe: no water.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Wetness, percs slowly.
56B---------------Nester	Moderate: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness.	Percs slowly.
56C---------------Nester	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness.	Slope, percs slowly.
57B---------------Kawkawlin	Slight---------	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness--------	Wetness, erodes easily, percs slowly.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
59B:						
Algonquin	Moderate: slope.	Severe: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Springport	Slight	Severe: ponding.	Severe: no water.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Wetness, percs slowly.
60D, 60E: Glennie	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
61C, 61D, 61F: Manistee	Severe: seepage, slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty, rooting depth.
62A: Allendale	Severe: seepage.	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly	Wetness, droughty.	Wetness, droughty, percs slowly.
63C, 63D, 63F: Bamfield	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Slope, erodes easily, rooting depth.
66D, 66E: Alcona	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
68: Rondeau	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides.	Ponding, soil blowing, percs slowly.	Wetness.
69: Loxley	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, too acid.	Wetness.
70: Lupton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
71: Tawas	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
72: Dorval	Severe: seepage.	Severe: ponding.	Severe: no water.	Ponding, percs slowly, subsides.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
73: Markey	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
74C2: Negwegon	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Wetness, slope, erodes easily.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
77---------------- Waucedah	Moderate: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, flooding, frost action.	Ponding, soil blowing, percs slowly.	Wetness, erodes easily.
78. Pits						
80F:						
Zimmerman--------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Alcona-----------	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
81B--------------- Grayling	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
81C, 81E---------- Grayling	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
82C--------------- Udorthents	Variable-------	Variable-------	Variable-------	Variable-------	Variable-------	Variable.
83F. Udipsamments						
84B--------------- Zimmerman	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
84C, 84D---------- Zimmerman	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
85B:						
Zimmerman--------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Alcona-----------	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Slope, cutbanks cave.	Slope, wetness, droughty.	Droughty.
85D:						
Zimmerman--------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Alcona-----------	Severe: slope.	Severe: piping.	Severe: no water.	Slope, cutbanks cave.	Slope, wetness, droughty.	Slope, droughty.
86:						
Histosols--------	Slight---------	Severe: excess humus, ponding.	Slight---------	Ponding, frost action.	Ponding, soil blowing.	Wetness.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
86:						
Aquents	Slight	Severe: ponding.	Slight	Ponding, frost action.	Ponding	Wetness.
87 Ausable	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, flooding, cutbanks cave.	Ponding, soil blowing, flooding.	Wetness.
88D Hoist	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Slope, rooting depth.
89F:						
Bamfield	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Slope, erodes easily, rooting depth.
Lupton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding	Wetness.
90B Chinwhisker	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Droughty.
91E:						
Glennie	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
Lupton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding	Wetness.
92B:						
Klacking	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
McGinn	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Rooting depth.
93B:						
Au Gres	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
Wakeley	Severe: seepage.	Severe: ponding.	Severe: no water.	Ponding, percs slowly.	Ponding, droughty, fast intake.	Wetness, droughty, percs slowly.
94F:						
Klacking	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
94F:						
McGinn-----------	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Slope, rooting depth.
96D2-------------- Negwegon	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, percs slowly, erodes easily.	Slope, erodes easily, percs slowly.
97---------------- Colonville	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, frost action, cutbanks cave.	Wetness, droughty, soil blowing.	Wetness, droughty.
98C--------------- Graycalm	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
102D, 102E, 102F-- Nester	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, percs slowly.
110D, 110F-------- Negwegon	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, percs slowly, erodes easily.	Slope, erodes easily, percs slowly.
111B-------------- Manistee	Severe: seepage.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, droughty.	Droughty, percs slowly.
209B, 210B-------- Grayling	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
210C, 210D-------- Grayling	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
211B-------------- Grayling	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
211C-------------- Grayling	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
212B-------------- Grayling	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
213B-------------- Graycalm	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
213C-------------- Graycalm	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
215C-------------- Typic Udipsamments	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
220B-------------- Typic Udipsamments	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
220C, 220D, 220E-- Typic Udipsamments	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
221B-------------- Typic Udipsamments	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
221C, 221D-------- Typic Udipsamments	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
222B-------------- Typic Udipsamments	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
223B:						
Graycalm---------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Grayling---------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
223C, 223D:						
Graycalm---------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Grayling---------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
224B-------------- Croswell	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Slope, cutbanks cave.	Slope, wetness, droughty.	Droughty.
225B-------------- Entic Haplorthods	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
225C-------------- Entic Haplorthods	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
230C:						
Entic Haplorthods	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Alfic Haplorthods	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
231B:						
Entic Haplorthods	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Alfic Haplorthods	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
231C, 231D:						
Entic Haplorthods	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Alfic Haplorthods	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
232B:						
Entic Haplorthods	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Alfic Haplorthods	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
233B:						
Alfic Haplorthods	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Entic Haplorthods	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
233C, 233D:						
Alfic Haplorthods	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Entic Haplorthods	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
235B:						
Alfic Haplorthods, sandy over loamy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Alfic Haplorthods, sandy-----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
235C, 235D:						
Alfic Haplorthods, sandy over loamy	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Alfic Haplorthods, sandy	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
236B, 236C. Arenic Eutroboralfs						
237B, 237C, 237D. Glossic Eutroboralfs						
247B:						
Glennie	Moderate: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, droughty.
Bamfield	Moderate: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, soil blowing.	Erodes easily, rooting depth, percs slowly.
247C, 247D:						
Glennie	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
Bamfield	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Slope, erodes easily, rooting depth.
250D:						
Glossic Eutroboralfs.						
Borosaprists.						
252A:						
Borosaprists.						
Au Gres	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
253A:						
Au Gres	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
Allendale	Severe: seepage.	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly	Wetness, droughty.	Wetness, droughty, percs slowly.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
253A:						
Croswell	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Droughty.
262A Au Gres	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
263A. Alfic Haplaquods						
264A Allendale	Severe: seepage.	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly	Wetness, droughty.	Wetness, droughty, percs slowly.
272:						
Haplaquods.						
Fluvaquents.						
273:						
Leafriver	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
Wakeley	Severe: seepage.	Severe: ponding.	Severe: no water.	Ponding, percs slowly.	Ponding, droughty, fast intake.	Wetness, droughty, percs slowly.
274. Typic Haplaquods						
280:						
Aquents.						
Histosols.						
281, 282. Borosaprists.						

Table 17.--Engineering Index Properties

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
11B Eastport	0-8	Sand	SP, SM, SP-SM	A-3, A-2-4, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
	8-29	Sand	SP, SM, SP-SM	A-3, A-2-4, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
	29-80	Sand	SP, SM, SP-SM	A-3, A-2-4, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
12B:											
Tawas	0-5	Muck	PT	A-8	0	---	---	---	---	---	---
	5-17	Muck	PT	A-8	0	---	---	---	---	---	---
	17-60	Sand	SP, SM, SP-SM	A-3, A-2-4, A-1-b	0	95-100	90-100	30-70	0-15	---	NP
Au Gres	0-10	Sand	SM, SP-SM, SP	A-2-4, A-3, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
	10-27	Sand, loamy sand	SP-SM, SM, SC-SM, SP	A-2-4, A-3, A-1-b	0	95-100	90-100	35-75	0-30	---	NP
	27-60	Sand	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
16B, 16C, 16D, 16E Graycalm	0-1	Sand	SM, SP-SM, SP	A-2, A-1, A-3	0	95-100	85-100	35-55	0-15	---	NP
	1-46	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2, A-1	0	95-100	85-100	30-75	0-30	---	NP
	46-80	Sand, loamy sand	SM, SP-SM, SP	A-2, A-1, A-3	0	95-100	85-100	30-75	0-30	---	NP
17B Croswell	0-4	Sand	SP-SM, SM	A-3, A-2-4, A-1-b	0	90-100	85-100	40-70	5-15	---	NP
	4-10	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	90-100	85-100	40-75	3-30	---	NP
	10-29	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	90-100	85-100	40-75	3-30	---	NP
	29-80	Sand	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	90-100	85-100	40-70	3-15	---	NP
18A Au Gres	0-10	Sand	SM, SP-SM, SP	A-2-4, A-3, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
	10-27	Sand, loamy sand	SP-SM, SM, SC-SM, SP	A-2-4, A-3, A-1-b	0	95-100	90-100	35-75	0-30	---	NP
	27-60	Sand	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	95-100	90-100	35-70	0-15	---	NP

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
19---------------- Leafriver	0-9	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	9-21	Loamy sand, sand	SM, SP-SM, SP	A-2-4	0	100	75-100	35-75	0-30	---	NP
	21-60	Loamy sand, fine sand, sand.	SM, SP-SM, SP	A-3, A-2, A-2-4, A-1	0	95-100	75-100	35-70	3-15	---	NP
26B--------------- Croswell	0-6	Sand-------------	SP-SM, SM, SP	A-3, A-2, A-1	0	90-100	85-100	40-70	0-25	---	NP
	6-35	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2, A-1	0	90-100	85-100	40-75	0-30	<20	NP-4
	35-50	Sand-------------	SP-SM, SM, SP	A-3, A-2, A-1	0	90-100	85-100	40-70	0-25	---	NP
	50-60	Stratified sandy loam to silty clay loam.	CL, SC, SC-SM, CL-ML	A-6, A-4, A-2	0	100	90-100	65-95	25-90	20-40	7-20
27A--------------- Au Gres	0-15	Sand-------------	SM, SP-SM, SP	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	15-44	Sand, loamy sand	SM, SP, SP-SM, SC-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	44-58	Sand-------------	SP, SP-SM	A-3, A-2	0	95-100	90-100	50-80	0-10	---	NP
	58-80	Clay, silty clay	CH, CL	A-7	0	100	100	90-100	75-95	45-60	30-40
28B, 28C, 28E---- East Lake	0-4	Sand-------------	SM, SP-SM, SP	A-1, A-2-4, A-3	0-15	95-100	85-100	40-70	0-15	---	NP
	4-30	Sand, loamy sand	SM, SP-SM, SP	A-1, A-2-4, A-3	0-5	90-100	75-100	35-75	0-30	---	NP
	30-60	Stratified very gravelly coarse sand to sand.	GP, SP-SM, SP	A-1, A-3, A-2-4	0-5	70-90	50-75	25-55	0-10	---	NP
29A--------------- Battlefield	0-9	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1	0-5	90-100	90-100	35-70	0-15	---	NP
	9-10	Sand, loamy sand	SP, SP-SM, SM, SC-SM	A-2-4, A-3, A-1	0-5	90-100	90-100	35-75	0-30	<25	NP-7
	10-33	Sand, loamy sand	SP, SP-SM, SM, SC-SM	A-2-4, A-3, A-1	0-5	90-100	90-100	35-75	0-30	<25	NP-7
	33-60	Gravelly sand, gravelly coarse sand.	SP, SW, SW-SM, SP-SM	A-1, A-2-4, A-3	0-5	70-90	60-75	30-55	0-10	---	NP
30---------------- Wheatley	0-5	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	5-34	Sand, loamy sand	SM, SP-SM	A-2-4, A-1-b, A-3	0-5	90-95	85-90	40-75	5-30	---	NP
	34-60	Gravelly sand, gravelly loamy sand.	SW, SP	A-1-b, A-1-a, A-2-4, A-3	5-15	70-90	50-75	25-60	0-20	---	NP-2
31B, 31C, 31D, 31E-------------- Klacking	0-3	Loamy sand-------	SM, SP-SM	A-2, A-1	0	90-100	85-100	35-75	10-30	---	NP
	3-27	Sand, loamy sand	SP-SM, SM, SP	A-2, A-1, A-3	0	90-100	85-100	35-75	0-30	---	NP
	27-60	Sand, loamy sand, sandy loam.	SP-SM, SM, SP, SC-SM	A-2, A-4, A-1, A-3	0	90-100	85-100	35-70	0-40	<25	NP-7

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
33B, 33C, 33D, 33E------------- Mancelona	0-5	Loamy sand-------	SM, SP-SM	A-2, A-1-b	0-15	90-100	85-95	35-80	10-35	---	NP
	5-31	Loamy sand, sand	SM, SP-SM	A-2, A-1-b, A-3	0-15	80-100	85-95	30-75	5-30	---	NP
	31-39	Very gravelly loam, sandy clay loam, sandy loam.	SC-SM, SC, SP-SC	A-2, A-4, A-6, A-1	0-15	85-100	55-95	35-80	10-50	20-35	4-15
	39-60	Stratified very gravelly sand, gravelly sand, sand.	GP, SP, GW, SW	A-1, A-2, A-3	0-15	40-70	30-55	20-60	0-15	---	NP
35--------------- Kinross	0-3	Muck-------------	PT	A-8	0	---	---	---	---	---	NP
	3-26	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	100	90-100	50-80	5-30	---	NP
	26-60	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	100	90-100	50-80	5-30	---	NP
36B, 36C--------- Alcona	0-3	Loamy very fine sand.	SM	A-2-4	0	95-100	90-100	70-95	15-35	<25	NP-4
	3-12	Loamy very fine sand, very fine sandy loam, fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4	0	95-100	90-100	55-95	15-65	<30	NP-10
	12-21	Loamy very fine sand, loam, very fine sandy loam.	SM, ML, SC, CL	A-4	0	95-100	90-100	70-95	35-65	<30	NP-10
	21-41	Sandy loam, very fine sandy loam, loam.	SC, SC-SM, CL, CL-ML	A-2-4, A-4	0	95-100	90-100	55-85	25-70	20-30	4-10
	41-60	Stratified fine sand to silt loam.	SM, ML, SC-SM, CL-ML	A-4, A-2-4	0	95-100	90-100	60-95	25-85	<30	NP-7
37A-------------- Richter	0-12	Loamy fine sand	SM, SP-SM	A-2, A-1	0	100	90-100	45-80	10-35	<20	NP-4
	12-37	Loamy sand, fine sandy loam, clay loam.	SM, SC, SC-SM	A-4, A-2, A-6, A-1	0	100	90-100	45-90	15-50	10-30	NP-16
	37-60	Stratified loamy sand to silt loam.	SM, SC, SC-SM	A-4, A-2, A-1	0	100	90-100	45-90	15-75	10-25	NP-10
38--------------- Tonkey	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-95	60-90	20-30	4-11
	6-26	Very fine sandy loam, silt loam.	SM, SC-SM, SC, ML	A-2, A-4	0	95-100	90-100	75-95	35-90	<25	NP-9
	26-60	Stratified silt loam, silt, very fine sandy loam.	SM, SC-SM, SC, ML	A-2, A-6, A-4	0-2	100	85-100	75-90	35-95	<30	NP-11

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
39B, 39C--------- Glennie	0-7	Loamy sand-------	SM, SP-SM	A-2, A-1	0-10	90-100	85-100	45-75	10-30	---	NP
	7-20	Loamy sand, sandy loam.	SM, SC-SM, SP-SM	A-2-4, A-1, A-4	0-10	90-100	85-100	45-75	10-40	<25	NP-7
	20-40	Loamy sand, sandy loam, loam.	SM, SC, ML, CL	A-2-4, A-4, A-2-6, A-6	0-10	90-100	85-100	45-85	10-75	10-35	NP-15
	40-46	Loamy sand, sandy clay loam, loam.	SM, SC, ML, CL	A-2-4, A-4, A-6, A-2-6	0-10	90-100	85-100	45-85	10-75	10-35	NP-15
	46-56	Clay, clay loam, sandy clay loam.	SC, CL, CH	A-7, A-6	0-10	90-100	85-100	65-95	45-90	30-65	10-35
	56-99	Sandy clay loam, clay loam, loam.	SC, CL	A-7, A-6, A-4	0-10	90-100	85-100	65-90	45-75	25-50	7-25
40A-------------- Sprinkler	0-5	Sandy loam-------	SC-SM, SM, SC	A-2-4, A-4	0-5	95-100	90-100	55-70	25-40	<30	NP-10
	5-13	Sandy loam-------	SC-SM, SM, SC	A-2-4, A-4	0-5	95-100	90-100	55-70	25-40	<30	NP-10
	13-28	Sandy loam, loam, clay loam.	SC, CL	A-6, A-7-6	0-5	95-100	90-100	55-90	35-80	25-45	10-20
	28-44	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	75-90	55-80	25-45	10-20
	44-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	75-90	55-80	25-45	10-20
41B, 41C, 41D---- McGinn	0-2	Loamy sand-------	SP-SM, SM	A-2-4, A-1-b	0-8	90-100	85-100	35-75	10-30	---	NP
	2-4	Loamy sand-------	SP-SM, SM	A-2-4, A-1-b	0-8	90-100	85-100	35-75	10-30	---	NP
	4-16	Loamy sand-------	SP-SM, SM	A-2-4, A-1-b	0-8	90-100	85-100	35-75	10-30	---	NP
	16-25	Loamy sand, sandy loam, loam.	SP-SM, SM, SC-SM, ML	A-2-4, A-1-b, A-4	0-8	90-100	85-100	35-95	10-60	<25	NP-7
	25-35	Sandy loam, loam	SC-SM, SC, CL, CL-ML	A-2-4, A-4, A-6	0-8	90-100	85-100	45-95	20-60	25-30	7-11
	35-80	Sandy loam-------	SM, SC-SM	A-2-4, A-4, A-1-b	0-8	90-100	85-100	45-80	20-50	<25	NP-7
42A-------------- Killmaster	0-8	Sandy loam-------	SM, SC-SM	A-4, A-2-4, A-1-b	0-8	90-100	85-100	45-85	20-50	<25	NP-7
	8-13	Sandy loam, loamy sand.	SM, SC-SM	A-4, A-2-4	0-8	90-100	85-100	45-85	25-50	<25	NP-6
	13-23	Loamy sand, sandy loam, loam.	SM, SC-SM, ML, CL-ML	A-4, A-2-4	0-8	90-100	85-100	35-85	25-70	<25	NP-7
	23-32	Sandy loam, loam	SC-SM, SC, ML, CL-ML	A-4, A-2-4	0-8	90-100	85-100	35-85	25-70	20-30	4-10
	32-80	Sandy loam-------	SM, SC-SM	A-4, A-2-4, A-1-b	0-8	90-95	85-90	45-80	20-50	<25	NP-7
43--------------- Wakeley	0-6	Mucky sand-------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	75-100	35-70	0-15	---	NP
	6-29	Sand, loamy sand	SP, SP-SM, SM, SC-SM	A-2-4, A-3	0-5	95-100	75-100	35-75	0-30	<25	NP-7
	29-60	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	95-100	90-100	85-100	75-95	40-65	20-40

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
44B--------------- Bamfield	0-6	Fine sandy loam	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	55-85	30-50	<30	NP-11
	6-11	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	50-85	25-50	<30	NP-11
	11-18	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	50-85	25-50	<30	NP-11
	18-31	Clay loam--------	CL	A-6, A-7	0-5	95-100	85-100	70-90	50-80	35-50	15-25
	31-60	Clay loam--------	CL	A-6, A-7	0-5	95-100	85-100	70-90	50-80	35-45	15-25
45B, 45C--------- Hoist	0-9	Sandy loam-------	SM, SC-SM	A-4, A-2-4, A-1-b	0-8	90-100	85-95	45-85	20-50	<25	NP-7
	9-14	Sandy loam-------	SM, SC-SM	A-4, A-2-4, A-1-b	0-8	90-100	85-95	45-85	20-50	<25	NP-7
	14-21	Sandy loam, loamy sand, loam.	SM, SC-SM, ML, CL-ML	A-4, A-2-4, A-1-b	0-8	90-100	85-95	35-85	20-60	<25	NP-7
	21-27	Loam, sandy loam	SC, SC-SM, CL, CL-ML	A-4, A-2-4, A-6	0-8	90-100	85-95	35-85	20-60	25-30	7-11
	27-49	Sandy loam-------	SM, SC-SM	A-4, A-2-4, A-1-b	0-8	90-100	85-95	35-75	20-50	<25	NP-7
	49-80	Sandy loam-------	SM, SC-SM	A-4, A-2-4, A-1-b	0-8	90-95	85-90	45-80	20-50	<25	NP-7
46--------------- Ensley	0-8	Mucky sandy loam	SC, SC-SM	A-4, A-6, A-2	0-10	90-100	85-100	35-75	25-50	20-30	4-11
	8-29	Sandy loam-------	SC, SC-SM	A-6, A-4, A-2, A-1	0-10	90-100	85-100	35-75	20-50	20-35	4-15
	29-60	Sandy loam-------	SC-SM, SM, SC	A-2, A-4, A-1	0-10	85-95	75-90	35-75	15-50	<30	2-9
53B, 53C--------- Negwegon	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	65-90	20-40	5-15
	8-46	Silty clay loam, silty clay, clay.	CL, CH	A-7	0	95-100	90-100	85-100	75-95	40-65	20-40
	46-60	Stratified silty clay to silt loam.	CL, CH	A-7	0	95-100	90-100	80-100	65-95	40-65	20-40
54A-------------- Algonquin	0-7	Silt loam--------	CL	A-4, A-6	0-2	95-100	95-100	80-100	70-90	25-40	7-15
	7-14	Silty clay, silty clay loam.	CL, CH	A-7	0-2	95-100	95-100	85-100	80-95	40-65	20-40
	14-29	Silty clay, silty clay loam.	CL, CH	A-7	0-2	95-100	95-100	85-100	80-95	40-65	20-40
	29-60	Silty clay, silty clay loam.	CL, CH	A-7	0-2	95-100	95-100	85-100	80-95	40-65	20-40

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
55---------------- Springport	0-8	Clay loam--------	CL	A-6, A-7	0-2	95-100	95-100	85-100	70-80	35-50	15-25
	8-12	Silty clay, silty clay loam.	CL, CH	A-7	0-2	95-100	95-100	85-100	80-95	40-65	20-40
	12-27	Silty clay, silty clay loam.	CL, CH	A-7	0-2	95-100	95-100	85-100	80-95	40-65	20-40
	27-60	Silty clay, silty clay loam.	CL, CH	A-7	0-2	95-100	95-100	85-100	80-95	40-65	20-40
56B, 56C--------- Nester	0-9	Loam-------------	ML, CL, CL-ML	A-4, A-6	0-5	90-100	85-100	65-100	50-90	15-35	2-15
	9-14	Loam, sandy loam, clay loam.	ML, CL, SC, SM	A-4, A-6, A-2-4, A-2-6	0-5	90-100	85-100	45-100	20-90	<35	NP-15
	14-40	Clay loam, silty clay loam, clay.	CL, CH	A-7	0-5	90-100	85-100	75-100	55-95	40-55	20-30
	40-60	Clay loam, silty clay loam.	CL	A-7	0-5	90-100	85-100	70-100	50-95	40-50	15-25
57B-------------- Kawkawlin	0-10	Loam-------------	ML, CL, CL-ML	A-4, A-6	0-5	95-100	85-100	70-95	50-75	20-40	2-15
	10-16	Clay loam, clay	CL, CH	A-7	0-5	95-100	85-100	75-100	55-95	40-55	20-30
	16-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	85-100	75-100	50-95	35-50	15-25
59B:											
Algonquin-------	0-7	Silt loam--------	CL	A-4, A-6	0-2	95-100	95-100	80-100	70-90	25-40	7-15
	7-14	Silty clay, silty clay loam.	CL, CH	A-7	0-2	95-100	95-100	85-100	80-95	40-65	20-40
	14-29	Silty clay, silty clay loam.	CL, CH	A-7	0-2	95-100	95-100	85-100	80-95	40-65	20-40
	29-60	Silty clay, silty clay loam.	CL, CH	A-7	0-2	95-100	95-100	85-100	80-95	40-65	20-40
Springport------	0-8	Clay loam--------	CL	A-6, A-7	0-2	95-100	95-100	85-100	70-80	35-50	15-25
	8-12	Silty clay, silty clay loam.	CL, CH	A-7	0-2	95-100	95-100	85-100	80-95	40-65	20-40
	12-27	Silty clay, silty clay loam.	CL, CH	A-7	0-2	95-100	95-100	85-100	80-95	40-65	20-40
	27-60	Silty clay, silty clay loam.	CL, CH	A-7	0-2	95-100	95-100	85-100	80-95	40-65	20-40
60D, 60E--------- Glennie	0-7	Loamy sand-------	SM, SP-SM	A-2-4, A-1	0-10	90-100	85-100	45-75	10-30	---	NP
	7-20	Loamy sand, sandy loam.	SM, SC-SM, SP-SM	A-2-4, A-1, A-4	0-10	90-100	85-100	45-75	10-40	<25	NP-7
	20-40	Loamy sand, sandy loam, loam.	SM, SC, ML, CL	A-2-4, A-4, A-2-6	0-10	90-100	85-100	45-85	10-75	10-35	NP-15
	40-46	Loamy sand, sandy loam, sandy clay loam.	SM, SC, ML, CL	A-2-4, A-4, A-6	0-10	90-100	85-100	45-85	10-75	10-35	NP-15
	46-56	Clay, clay loam, sandy clay loam.	SC, CL, CH	A-7, A-6	0-10	90-100	85-100	65-90	45-90	30-65	10-35
	56-99	Sandy clay loam, clay loam, loam.	SC, CL	A-7, A-6, A-4	0-10	90-100	85-100	65-90	45-75	25-50	7-25
61C, 61D, 61F---- Manistee	0-6	Loamy sand-------	SM, SP-SM	A-2-4, A-1-b	0	95-100	90-100	45-75	10-30	---	NP
	6-24	Sand, loamy sand	SP-SM, SM	A-2-4, A-1-b, A-3	0-2	95-100	90-100	45-75	5-30	---	NP
	24-50	Clay, silty clay	CH, CL	A-7	0	95-100	90-100	85-100	75-95	40-65	20-40
	50-60	Clay, silty clay	CH, CL	A-7	0	95-100	90-100	85-100	70-95	40-65	20-40

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
62A-------------- Allendale	0-11	Loamy sand-------	SM, SP-SM	A-2-4, A-1-b, A-4	0	95-100	90-100	45-80	10-30	---	NP
	11-25	Sand, loamy sand	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-80	5-30	---	NP
	25-60	Silty clay, clay	CH, MH	A-7	0	100	90-100	90-100	75-95	50-70	20-40
63C, 63D, 63F---- Bamfield	0-6	Fine sandy loam	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	55-85	30-50	<30	NP-11
	6-11	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	50-85	25-50	<30	NP-11
	11-18	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	50-85	25-50	<30	NP-11
	18-31	Clay loam--------	CL	A-6, A-7	0-5	95-100	85-100	70-90	50-80	35-50	15-25
	31-60	Clay loam--------	CL	A-6, A-7	0-5	95-100	85-100	70-90	50-80	35-45	15-25
66D, 66E--------- Alcona	0-3	Loamy very fine sand.	SM	A-2-4	0	95-100	90-100	70-95	15-35	<25	NP-4
	3-12	Loamy very fine sand, very fine sandy loam, fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4	0	95-100	90-100	55-95	15-65	<30	NP-10
	12-21	Loamy very fine sand, loam, very fine sandy loam.	SM, ML, SC, CL	A-4	0	95-100	90-100	70-95	35-65	<30	NP-10
	21-41	Fine sandy loam, very fine sandy loam, loam.	SC, SC-SM, CL, CL-ML	A-2-4, A-4	0	95-100	90-100	55-85	25-70	20-30	4-10
	41-60	Stratified fine sand to silt loam.	SM, ML, SC, CL	A-2-4, A-4	0	95-100	90-100	60-95	25-85	<30	NP-10
68--------------- Rondeau	0-19	Muck-------------	PT	A-8	0	---	---	---	---	---	NP
	19-60	Marl-------------	OH, MH	A-8, A-5, A-7	0	100	95-100	80-90	60-80	50-90	NP-20
69--------------- Loxley	0-18	Peat-------------	PT	A-8	0	---	---	---	---	---	---
	18-60	Muck-------------	PT	A-8	0	---	---	---	---	---	---
70--------------- Lupton	0-5	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	5-60	Muck-------------	PT	A-8	0	---	---	---	---	---	---
71--------------- Tawas	0-5	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	5-17	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	17-60	Sand-------------	SP, SM, SP-SM	A-3, A-2-4, A-1-b	0	95-100	90-100	30-70	0-15	---	NP
72--------------- Dorval	0-27	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	27-60	Silty clay, clay	CH, CL	A-7	0	100	90-100	90-100	80-100	45-70	25-40
73--------------- Markey	0-28	Muck-------------	PT	A-8	---	---	---	---	---	---	---
	28-60	Sand-------------	SP, SM, SP-SM	A-2, A-3, A-1	0	95-100	60-100	30-75	0-15	---	NP

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
74C2: Negwegon	0-8	Silty clay loam	CL	A-6, A-7	0	95-100	90-100	80-100	75-95	35-50	15-25
	8-40	Silty clay loam, silty clay, clay.	CL, CH	A-7	0	95-100	90-100	85-100	75-95	40-65	20-40
	40-60	Stratified silty clay to silt loam.	CL, CH	A-7	0	95-100	90-100	80-100	65-95	40-65	20-40
77: Waucedah	0-9	Muck	PT	A-8	0	---	---	---	---	---	---
	9-13	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-30	6-11
	13-18	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-30	6-11
	18-55	Loamy sand, sandy loam.	SC, SM, SC-SM	A-2-4, A-4	0	100	100	50-75	15-40	<25	NP-8
	55-60	Silty clay	CL, CH	A-7-6	0	100	100	80-100	80-100	45-65	25-40
78. Pits											
80F: Zimmerman	0-4	Loamy fine sand	SM	A-2	0	100	100	95-100	15-30	<20	NP
	4-80	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	95-100	5-20	<20	NP
Alcona	0-3	Loamy very fine sand.	SM	A-2-4	0	95-100	90-100	70-95	15-35	<25	NP-4
	3-12	Loamy very fine sand, very fine sandy loam, fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4	0	95-100	90-100	55-95	15-65	<30	NP-10
	12-21	Loamy very fine sand, loam, very fine sandy loam.	SM, ML, SC, CL	A-4	0	95-100	90-100	70-95	35-65	<30	NP-10
	21-41	Fine sandy loam, very fine sandy loam, loam.	SC, SC-SM, CL, CL-ML	A-2-4, A-4	0	95-100	90-100	55-85	25-70	20-30	4-10
	41-60	Stratified fine sand to silt loam.	SM, ML, SC, CL	A-2-4, A-4	0	95-100	90-100	60-95	25-85	<30	NP-10
81B, 81C, 81E: Grayling	0-2	Sand	SM, SP-SM, SP	A-1, A-2, A-3	0	95-100	90-100	45-70	3-15	---	NP
	2-29	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	45-70	3-15	---	NP
	29-63	Sand, coarse sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	40-70	0-15	---	NP
	63-80	Sand, coarse sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	40-70	0-15	---	NP
82C. Udorthents											
83F. Udipsamments											
84B, 84C, 84D: Zimmerman	0-4	Loamy fine sand	SM	A-2	0	100	100	95-100	15-30	<20	NP
	4-80	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	95-100	5-20	<20	NP
85B, 85D: Zimmerman	0-4	Loamy fine sand	SM	A-2	0	100	100	95-100	15-30	<20	NP
	4-80	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	95-100	5-20	<20	NP

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
85B, 85D:											
Alcona----------	0-3	Loamy very fine sand.	SM	A-2-4	0	95-100	90-100	70-95	15-35	<25	NP-4
	3-12	Loamy very fine sand, very fine sandy loam, fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4	0	95-100	90-100	55-95	15-65	<30	NP-10
	12-21	Loamy very fine sand, loam, very fine sandy loam.	SM, ML, SC, CL	A-4	0	95-100	90-100	70-95	35-65	<30	NP-10
	21-41	Fine sandy loam, very fine sandy loam, loam.	SC, SC-SM, CL, CL-ML	A-2-4, A-4	0	95-100	90-100	55-85	25-70	20-30	4-10
	41-60	Stratified fine sand to silt loam.	SM, ML, SC-SM, CL-ML	A-4, A-2-4	0	95-100	90-100	60-95	25-85	<30	NP-7
86:											
Histosols.											
Aquents.											
87--------------- Ausable	0-8	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	8-17	Sand, loamy sand	SP-SM, SM	A-3, A-2-4	0-15	95-100	85-100	50-75	5-30	---	NP
	17-60	Sand, loamy sand	SP, SM, SP-SM	A-3, A-2-4, A-1	0-15	95-100	85-100	50-75	0-30	---	NP
88D-------------- Hoist	0-9	Sandy loam-------	SM, SC-SM	A-4, A-2-4, A-1-b	0-8	90-100	85-95	45-85	20-50	<25	NP-7
	9-14	Sandy loam-------	SM, SC-SM	A-4, A-2-4, A-1-b	0-8	90-100	85-95	45-85	20-50	<25	NP-7
	14-21	Sandy loam, loamy sand, loam.	SM, SC-SM	A-4, A-2-4, A-1-b	0-8	90-100	85-95	35-85	20-50	<25	NP-7
	21-27	Loam, sandy loam	SC, SC-SM, CL, CL-ML	A-4, A-2-4, A-6	0-8	90-100	85-95	35-85	20-60	25-30	7-11
	27-49	Sandy loam-------	SM, SC-SM	A-4, A-2-4, A-1-b	0-8	90-100	85-95	35-75	20-50	<25	NP-7
	49-80	Sandy loam-------	SM, SC-SM	A-4, A-2-4, A-1-b	0-8	90-100	85-90	45-80	20-50	<25	NP-7
89F:											
Bamfield--------	0-6	Fine sandy loam	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	55-85	30-50	<30	NP-11
	6-11	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	50-85	25-50	<30	NP-11
	11-18	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	50-85	25-50	<30	NP-11
	18-31	Clay loam--------	CL	A-6, A-7	0-5	95-100	85-100	70-90	50-80	35-50	15-25
	31-60	Clay loam--------	CL	A-6, A-7	0-5	95-100	85-100	70-90	50-80	35-45	15-25

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
89F:											
Lupton----------	0-5	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	5-60	Muck-------------	PT	A-8	0	---	---	---	---	---	---
90B-------------- Chinwhisker	0-3	Sand-------------	SM, SP-SM, SP	A-2-4, A-1-b, A-3	0	95-100	75-100	35-70	0-15	---	NP
	3-8	Sand, loamy sand	SM, SP-SM, SP	A-2-4, A-1-b, A-3	0	95-100	75-100	35-70	0-25	---	NP
	8-21	Sand, loamy sand	SM, SP-SM, SP	A-2-4, A-1-b, A-3	0	95-100	75-100	35-70	0-25	---	NP
	21-36	Sand-------------	SM, SP-SM, SP	A-2-4, A-1-b, A-3	0	95-100	75-100	35-70	0-15	---	NP
	36-80	Stratified sand to loamy sand.	SM, SP-SM, SP	A-2-4, A-1-b, A-3	0	95-100	75-100	35-75	0-25	---	NP
91E:											
Glennie---------	0-7	Loamy sand-------	SM, SP-SM	A-2-4, A-1	0-10	90-100	85-100	45-75	10-30	---	NP
	7-20	Loamy sand, sandy loam.	SM, SC-SM, SP-SM	A-2-4, A-1, A-4	0-10	90-100	85-100	45-75	10-40	<25	NP-7
	20-40	Loamy sand, sandy loam, loam.	SM, SC, ML, CL	A-2-4, A-4, A-2-6	0-10	90-100	85-100	45-85	10-75	10-35	NP-15
	40-46	Loamy sand, sandy clay loam, loam.	SM, SC, ML, CL	A-2-4, A-4, A-6	0-10	90-100	85-100	45-85	10-75	10-35	NP-15
	46-56	Clay, clay loam, sandy clay loam.	SC, CL, CH	A-7, A-6	0-10	90-100	85-100	65-90	45-90	30-65	10-35
	56-99	Sandy clay loam, clay loam, loam.	SC, CL	A-7, A-6, A-4	0-10	90-100	85-100	65-90	45-75	25-50	7-25
Lupton----------	0-5	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	5-60	Muck-------------	PT	A-8	0	---	---	---	---	---	---
92B:											
Klacking--------	0-3	Loamy sand-------	SM, SP-SM	A-2, A-1	0	90-100	85-100	35-75	10-30	---	NP
	3-27	Sand, loamy sand	SP-SM, SM, SP	A-2, A-1, A-3	0	90-100	85-100	35-75	0-30	---	NP
	27-60	Sand, loamy sand, sandy loam.	SP-SM, SM, SP, SC-SM	A-2, A-4, A-1, A-3	0	90-100	85-100	35-70	0-40	<25	NP-7
McGinn----------	0-2	Loamy sand-------	SP-SM, SM	A-2-4, A-1-b	0-8	90-100	85-100	35-75	10-30	---	NP
	2-4	Loamy sand-------	SP-SM, SM	A-2-4, A-1-b	0-8	90-100	85-100	35-75	10-30	---	NP
	4-16	Loamy sand-------	SP-SM, SM	A-2-4, A-1-b	0-8	90-100	85-100	35-75	10-30	---	NP
	16-25	Loamy sand, sandy loam, loam.	SP-SM, SM, SC-SM, ML	A-2-4, A-1-b, A-4	0-8	90-100	85-100	35-95	10-60	<25	NP-7
	25-35	Sandy loam, loam	SC-SM, SC, CL, CL-ML	A-2-4, A-4, A-6	0-8	90-100	85-100	45-95	20-60	25-30	7-11
	35-80	Sandy loam-------	SM, SC-SM	A-2-4, A-4, A-1-b	0-8	90-100	85-100	45-80	20-50	<25	NP-7

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
93B:											
Au Gres----------	0-15	Sand--------------	SM, SP-SM, SP	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	15-44	Sand, loamy sand	SM, SP, SP-SM, SC-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	44-58	Sand--------------	SP, SP-SM	A-3, A-2	0	95-100	90-100	50-80	0-10	---	NP
	58-80	Clay, silty clay	CH, CL	A-7	0	100	100	90-100	75-95	45-60	30-40
Wakeley----------	0-6	Mucky sand--------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	75-100	35-70	0-15	---	NP
	6-29	Sand, loamy sand	SP, SP-SM, SM, SC-SM	A-2-4, A-3	0-5	95-100	75-100	35-75	0-30	<25	NP-7
	29-60	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	95-100	90-100	85-100	75-95	40-65	20-40
94F:											
Klacking---------	0-3	Loamy sand--------	SM, SP-SM	A-2, A-1	0	90-100	85-100	35-75	10-30	---	NP
	3-27	Sand, loamy sand	SP-SM, SM, SP	A-2, A-1, A-3	0	90-100	85-100	35-75	0-30	---	NP
	27-60	Sand, loamy sand, sandy loam.	SP-SM, SM, SP, SC-SM	A-2, A-4, A-1, A-3	0	90-100	85-100	35-70	0-40	<25	NP-7
McGinn-----------	0-2	Loamy sand--------	SP-SM, SM	A-2-4, A-1-b	0-8	90-100	85-100	35-75	10-30	---	NP
	2-4	Loamy sand--------	SP-SM, SM	A-2-4, A-1-b	0-8	90-100	85-100	35-75	10-30	---	NP
	4-16	Loamy sand--------	SP-SM, SM	A-2-4, A-1-b	0-8	90-100	85-100	35-75	10-30	---	NP
	16-25	Loamy sand, sandy loam, loam.	SP-SM, SM, SC-SM, ML	A-2-4, A-1-b, A-4	0-8	90-100	85-100	35-95	10-60	<25	NP-7
	25-35	Sandy loam, loam	SC-SM, SC, CL, CL-ML	A-2-4, A-4, A-6	0-8	90-100	85-100	45-95	20-60	25-30	7-11
	35-80	Sandy loam--------	SM, SC-SM	A-2-4, A-4, A-1-b	0-8	90-100	85-100	45-80	20-50	<25	NP-7
96D2-------------- Negwegon	0-6	Silty clay loam	CL	A-6, A-7	0	95-100	90-100	80-100	75-95	35-50	15-25
	6-40	Silty clay loam, silty clay, clay.	CL, CH	A-7	0	95-100	90-100	85-100	75-95	40-65	20-40
	40-60	Stratified silty clay to silt loam.	CL, CH	A-7	0	95-100	90-100	80-100	65-95	40-65	20-40
97--------------- Colonville	0-11	Very fine sandy loam.	CL, CL-ML	A-4	0	100	100	85-95	50-65	20-25	4-8
	11-60	Fine sandy loam, loamy fine sand, silt loam.	SM, SC, ML, CL	A-4, A-1-b, A-2-4	0	90-100	75-100	35-85	5-55	<30	NP-9
98C-------------- Graycalm	0-1	Sand--------------	SM, SP-SM, SP	A-2, A-1, A-3	0	95-100	85-100	35-55	0-15	---	NP
	1-46	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2, A-1	0	95-100	85-100	30-75	0-30	---	NP
	46-80	Sand, loamy sand, loamy coarse sand.	SM, SP-SM, SP	A-2, A-1, A-3	0	95-100	85-100	30-75	0-30	---	NP

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
102D, 102E, 102F-- Nester	0-9	Loam-------------	ML, CL, CL-ML	A-4, A-6	0-5	90-100	85-100	65-100	50-90	15-35	2-15
	9-14	Loam, sandy loam, clay loam.	ML, SM	A-4, A-2-4, A-1-b	0-5	90-100	85-100	45-100	20-90	<35	NP-7
	14-25	Clay loam, silty clay loam, clay.	CL, CH	A-7	0-5	90-100	85-100	75-100	55-95	40-55	20-30
	25-60	Clay loam, silty clay loam.	CL	A-7	0-5	90-100	85-100	70-100	50-95	40-50	15-25
110D------------- Negwegon	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	65-90	20-40	6-15
	8-46	Silty clay loam, silty clay, clay.	CL, CH	A-7	0	95-100	90-100	85-100	75-95	40-65	20-40
	46-60	Stratified silty clay to silt loam.	CL, CH	A-7	0	95-100	90-100	80-100	65-95	40-65	20-40
110F------------- Negwegon	0-4	Silt loam--------	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	65-90	20-40	6-15
	4-40	Silty clay loam, silty clay, clay.	CL, CH	A-7	0	95-100	90-100	85-100	75-95	40-65	20-40
	40-60	Stratified silty clay to silt loam.	CL, CH	A-7	0	95-100	90-100	80-100	65-95	40-65	20-40
111B------------- Manistee	0-6	Loamy sand-------	SM, SP-SM	A-2-4, A-1-b	0-2	95-100	90-100	45-75	10-30	---	NP
	6-24	Sand, loamy sand	SP-SM, SM	A-2-4, A-1-b, A-3	0-2	95-100	90-100	45-75	5-30	---	NP
	24-50	Clay, silty clay	CH, CL	A-7	0	100	100	90-100	80-95	45-65	25-40
	50-60	Clay, silty clay	CH, CL	A-7	0	100	100	90-100	85-95	45-65	20-40
209B------------- Grayling	0-2	Sand-------------	SM, SP-SM	A-3, A-1-b, A-2-4	0	90-100	85-100	40-70	5-15	---	NP
	2-29	Sand-------------	SM, SP-SM	A-3, A-1-b, A-2-4	0	90-100	85-100	40-70	5-15	---	NP
	29-70	Sand, coarse sand	SM, SP-SM, SP	A-3, A-1-b, A-2-4	0	90-100	85-100	40-70	0-15	---	NP
	70-180	Sand-------------	SM, SP-SM, SP	A-3, A-1-b, A-2-4	0	90-100	85-100	40-70	0-15	---	NP
210B, 210C, 210D-- Grayling	0-2	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	95-100	90-100	45-70	3-15	---	NP
	2-29	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	45-70	3-15	---	NP
	29-63	Sand, coarse sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	40-70	0-15	---	NP
	63-180	Sand, coarse sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	40-70	0-15	---	NP

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
211B, 211C: Grayling	0-3	Sand	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	3-35	Sand	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	35-60	Sand, coarse sand	SM, SP-SM, SP	A-3, A-1, A-2	0	90-100	85-100	40-70	0-15	---	NP
	60-180	Stratified sand to loamy fine sand.	SM, SC-SM, SC, SP-SM	A-3, A-1, A-2, A-4	0	90-100	85-100	40-90	5-50	<30	NP-10
212B: Grayling	0-3	Sand	SM, SP-SM	A-1, A-2, A-3	0	90-100	85-100	45-70	5-15	---	NP
	3-30	Sand	SP-SM, SM	A-1, A-2, A-3	0	90-100	85-100	45-70	5-15	---	NP
	30-180	Sand, coarse sand	SP, SP-SM, SM	A-1, A-2, A-3	0	90-100	85-100	40-70	0-15	---	NP
213B, 213C: Graycalm	0-1	Sand	SM, SP-SM, SP	A-2, A-1, A-3	0	95-100	85-100	35-55	0-15	---	NP
	1-46	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2, A-1	0	95-100	85-100	30-75	0-30	---	NP
	46-70	Sand, loamy sand	SM, SP-SM, SP	A-2, A-1, A-3	0	95-100	85-100	30-75	0-30	---	NP
	70-180	Sand, coarse sand	SP, SP-SM, SM	A-2, A-1, A-3	0	95-100	85-100	35-55	0-15	---	NP
215C: Typic Udipsamments	0-2	Sand	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	2-25	Sand	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	25-75	Sand, coarse sand	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	75-95	Sandy loam, sandy clay loam.	SC, CL, CL-ML, SC-SM	A-2, A-4, A-6	0	90-100	85-100	50-90	25-50	20-40	4-18
220B, 220C, 220D, 220E: Typic Udipsamments	0-2	Sand	SM, SP-SM	A-3, A-1-b, A-2-4	0	90-100	85-100	40-70	5-15	---	NP
	2-40	Sand, loamy sand	SM, SP-SM	A-3, A-1-b, A-2-4	0	90-100	85-100	40-70	5-30	---	NP
	40-180	Sand, coarse sand	SP, SP-SM	A-3, A-1-b, A-2-4	0	90-100	85-100	40-70	0-5	---	NP
221B, 221C, 221D: Typic Udipsamments	0-3	Sand	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	3-30	Sand, loamy sand	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-30	---	NP
	30-45	Sand, coarse sand	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	45-180	Stratified sand to sandy loam.	SM, SC-SM, SC, SP-SM	A-3, A-1, A-2, A-4	0	90-100	85-100	40-70	5-40	<30	NP-10

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
222B-------------Typic Udipsamments	0-2	Sand-------------	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	2-30	Sand, loamy sand	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-30	---	NP
	30-100	Sand, coarse sand	SP, SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	0-15	---	NP
223B, 223C, 223D:											
Graycalm--------	0-1	Sand-------------	SM, SP-SM, SP	A-2, A-1, A-3	0	95-100	85-100	35-55	0-15	---	NP
	1-46	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2, A-1	0	95-100	85-100	30-75	0-30	---	NP
	46-70	Sand, loamy sand	SM, SP-SM, SP	A-2, A-1, A-3	0	95-100	85-100	30-75	0-30	---	NP
	70-180	Sand, coarse sand	SP, SP-SM, SM	A-2, A-1, A-3	0	95-100	85-100	35-55	0-15	---	NP
Grayling--------	0-2	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	95-100	90-100	45-70	3-15	---	NP
	2-29	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	45-70	3-15	---	NP
	29-63	Sand, coarse sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	40-70	0-15	---	NP
	63-180	Sand, coarse sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	40-70	0-15	---	NP
224B-------------Croswell	0-4	Sand-------------	SP-SM, SM	A-3, A-2-4, A-1-b	0	90-100	85-100	40-70	5-15	---	NP
	4-10	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	90-100	85-100	40-75	3-30	---	NP
	10-29	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	90-100	85-100	40-75	3-30	---	NP
	29-80	Sand-------------	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	90-100	85-100	40-70	3-15	---	NP
225B, 225C-------Entic Haplorthods	0-2	Sand-------------	SP-SM, SM	A-2, A-1, A-3	0	95-100	90-100	45-70	5-15	---	NP
	2-30	Sand, fine sand, loamy sand.	SP, SP-SM, SM	A-2, A-1, A-3	0	95-100	90-100	45-90	3-35	---	NP
	30-55	Sand, coarse sand	SP, SP-SM, SM	A-2, A-1, A-3	0	95-100	90-100	45-70	0-15	---	NP
	55-80	Sandy clay loam, clay loam.	SC, CL	A-6, A-7, A-2-7	0	95-100	85-100	65-95	30-80	30-50	10-25
230C:											
Entic Haplorthods----	0-2	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-15	---	NP
	2-35	Sand, fine sand, loamy sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-90	3-35	---	NP
	35-180	Sand, coarse sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	35-70	0-15	---	NP

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
230C:											
Alfic Haplorthods	0-4	Loamy sand	SM, SP-SM	A-2-4, A-1-b	0	90-100	75-100	35-75	10-30	---	NP
	4-37	Sand, loamy sand	SP, SP-SM, SM	A-2-4, A-1-b, A-3	0	90-100	75-100	35-75	0-30	---	NP
	37-42	Sandy loam, silt loam, sandy clay loam.	SC-SM, SC, CL-ML, CL	A-2-4, A-4, A-6	0	90-100	75-100	45-95	20-80	20-40	4-18
	42-180	Sand, loamy sand, coarse sand.	SP, SP-SM, SM	A-2-4, A-1-b, A-3	0	90-100	75-100	35-75	0-30	---	NP
231B, 231C, 231D:											
Entic Haplorthods	0-2	Sand	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	85-100	45-70	1-15	---	NP
	2-30	Sand, loamy sand	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	85-100	45-70	1-30	---	NP
	30-60	Sand	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	85-100	45-70	1-15	---	NP
	60-180	Stratified sand to sandy loam.	SP, SM, SC-SM, SC	A-3, A-1, A-2, A-4	0	95-100	85-100	40-70	1-40	0-30	NP-10
Alfic Haplorthods	0-4	Loamy sand	SM, SP-SM	A-2-4, A-1-b	0	90-100	75-100	35-75	10-30	---	NP
	4-37	Sand, loamy sand	SP, SP-SM, SM	A-2-4, A-1-b, A-3	0	90-100	75-100	35-75	0-30	---	NP
	37-42	Sandy loam, silt loam, sandy clay loam.	SC-SM, SC, CL-ML, CL	A-2-4, A-4, A-6	0	90-100	75-100	45-95	20-80	20-40	4-18
	42-180	Sand, loamy sand, coarse sand.	SP, SP-SM, SM	A-2-4, A-1-b, A-3	0	90-100	75-100	35-75	0-30	---	NP
232B:											
Entic Haplorthods	0-2	Sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-15	---	NP
	2-30	Sand, loamy sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-30	---	NP
	30-100	Sand, coarse sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	0-15	---	NP

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
232B:											
Alfic Haplorthods----	0-4	Loamy sand-------	SM, SP-SM	A-2-4, A-1-b	0	95-100	75-100	35-75	10-30	---	NP
	4-37	Sand, loamy sand	SP, SP-SM, SM	A-2-4, A-1-b, A-3	0	95-100	75-100	35-75	0-30	---	NP
	37-42	Sandy loam, silt loam, sandy clay loam.	SC-SM, SC, CL-ML, CL	A-2-4, A-4, A-6	0	95-100	75-100	45-95	20-80	20-40	4-18
	42-100	Sand, loamy sand, coarse sand.	SP, SP-SM, SM	A-2-4, A-1-b, A-3	0	95-100	75-100	35-75	0-30	---	NP
233B, 233C, 233D:											
Alfic Haplorthods----	0-4	Loamy sand-------	SM, SP-SM	A-2-4, A-1-b	0	90-100	75-100	35-75	10-30	---	NP
	4-37	Sand, loamy sand	SP, SP-SM, SM	A-2-4, A-1-b, A-3	0	90-100	75-100	35-75	0-30	---	NP
	37-42	Sandy loam, silt loam, sandy clay loam.	SC-SM, SC, CL-ML, CL	A-2-4, A-4, A-6	0	90-100	75-100	45-95	20-80	20-40	4-18
	42-180	Sand, loamy sand, coarse sand.	SP, SP-SM, SM	A-2-4, A-1-b, A-3	0	90-100	75-100	35-75	0-30	---	NP
Entic Haplorthods---	0-2	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-15	---	NP
	2-30	Sand, loamy sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-30	---	NP
	30-55	Sand, coarse sand	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	0-15	---	NP
	55-180	Stratified sand to sandy clay loam.	SM, SC, CL, ML	A-3, A-2, A-4, A-6	0	95-100	85-100	40-90	5-55	0-40	NP-20
235B, 235C, 235D:											
Alfic Haplorthods, sandy over loamy----------	0-4	Sand-------------	SP-SM, SM	A-2-4, A-3, A-1-b	0	90-100	85-100	40-70	5-15	---	NP
	4-6	Sand, loamy sand	SP-SM, SM	A-2-4, A-3, A-1-b	0	90-100	85-100	40-75	5-30	---	NP
	6-27	Sand, loamy sand	SP-SM, SM	A-2-4, A-3, A-1-b	0	90-100	85-100	40-75	5-30	---	NP
	27-44	Sandy clay loam, silt loam, silty clay loam.	SC, CL	A-6, A-7, A-2-6	0	85-100	75-100	60-95	30-90	30-50	11-25
	44-120	Sand, loamy sand	SP-SM, SM	A-2-4, A-3, A-1-b	0	85-100	75-100	40-75	0-30	<25	NP-7

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
235B, 235C, 235D: Alfic Haplorthods, sandy----------	0-4	Loamy sand-------	SM, SP-SM	A-2-4, A-1-b	0	90-100	75-100	35-75	10-30	---	NP
	4-37	Sand, loamy sand	SP, SP-SM, SM	A-2-4, A-1-b, A-3	0	90-100	75-100	35-75	0-30	---	NP
	37-42	Sandy loam, silt loam, sandy clay loam.	SC-SM, SC, CL-ML, CL	A-2-4, A-4, A-6	0	90-100	75-100	45-95	20-85	20-40	4-18
	42-180	Sand, loamy sand, coarse sand.	SP, SP-SM, SM	A-2-4, A-1-b, A-3	0	90-100	75-100	35-75	0-30	---	NP
236B, 236C. Arenic Eutroboralfs											
237B, 237C, 237D. Glossic Eutroboralfs											
247B, 247C: Glennie---------	0-7	Loamy sand-------	SM, SP-SM	A-2, A-1	0-10	90-100	85-100	45-75	10-30	---	NP
	7-20	Loamy sand, sandy loam.	SM, SC-SM, SP-SM	A-2-4, A-1, A-4	0-10	90-100	85-100	45-75	10-40	<25	NP-7
	20-40	Loamy sand, sandy loam, loam.	SM, SC, ML, CL	A-2-4, A-4, A-2-6, A-6	0-10	90-100	85-100	45-85	10-75	10-35	NP-15
	40-46	Loamy sand, sandy clay loam, loam.	SM, SC, ML, CL	A-2-4, A-4, A-6, A-2-6	0-10	90-100	85-100	45-85	10-75	10-35	NP-15
	46-56	Clay, clay loam, sandy clay loam.	SC, CL, CH	A-7, A-6	0-10	90-100	85-100	65-95	45-90	30-65	10-35
	56-99	Sandy clay loam, clay loam, loam.	SC, CL	A-7, A-6, A-4	0-10	90-100	85-100	65-90	45-75	25-50	7-25
Bamfield--------	0-6	Fine sandy loam	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	55-85	30-50	<30	NP-11
	6-11	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	50-85	25-50	<30	NP-11
	11-18	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	50-85	25-50	<30	NP-11
	18-31	Clay loam--------	CL	A-6, A-7	0-5	95-100	85-100	70-90	50-80	35-50	15-25
	31-60	Clay loam--------	CL	A-6, A-7	0-5	95-100	85-100	70-90	50-80	35-45	15-25

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
247D:											
Glennie---------	0-7	Loamy sand-------	SM, SP-SM	A-2-4, A-1	0-10	90-100	85-100	45-75	10-30	---	NP
	7-20	Loamy sand, sandy loam.	SM, SC-SM, SP-SM	A-2-4, A-1, A-4	0-10	90-100	85-100	45-75	10-40	<25	NP-7
	20-40	Loamy sand, sandy loam, loam.	SM, SC, ML, CL	A-2-4, A-4, A-2-6	0-10	90-100	85-100	45-85	10-75	10-35	NP-15
	40-46	Loamy sand, sandy clay loam, loam.	SM, SC, ML, CL	A-2-4, A-4, A-6	0-10	90-100	85-100	45-85	10-75	10-35	NP-15
	46-56	Clay, clay loam, sandy clay loam.	SC, CL, CH	A-7, A-6	0-10	90-100	85-100	65-90	45-90	30-65	10-35
	56-99	Sandy clay loam, clay loam, loam.	SC, CL	A-7, A-6, A-4	0-10	90-100	85-100	65-90	45-75	25-50	7-25
Bamfield--------	0-6	Fine sandy loam	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	55-85	30-50	<30	NP-11
	6-11	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	50-85	25-50	<30	NP-11
	11-18	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4, A-2-6, A-6	0-5	95-100	85-100	50-85	25-50	<30	NP-11
	18-31	Clay loam--------	CL	A-6, A-7	0-5	95-100	85-100	70-90	50-80	35-50	15-25
	31-60	Clay loam--------	CL	A-6, A-7	0-5	95-100	85-100	70-90	50-80	35-45	15-25
250D:											
Glossic Eutroboralfs.											
Borosaprists.											
252A:											
Borosaprists.											
Au Gres---------	0-10	Sand-------------	SM, SP-SM, SP	A-2-4, A-3, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
	10-27	Sand, loamy sand	SP-SM, SM, SC-SM, SP	A-2-4, A-3, A-1-b	0	95-100	90-100	35-75	0-30	<25	NP-7
	27-60	Sand-------------	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
253A:											
Au Gres---------	0-10	Sand-------------	SM, SP-SM, SP	A-2-4, A-3, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
	10-27	Sand, loamy sand	SP-SM, SM, SC-SM, SP	A-2-4, A-3, A-1-b	0	95-100	90-100	35-75	0-30	<25	NP-7
	27-60	Sand-------------	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	95-100	90-100	35-70	0-15	---	NP

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
253A:											
Allendale-------	0-11	Sand-------------	SM, SW-SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-80	5-15	---	NP
	11-25	Sand, loamy sand	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-80	5-30	---	NP
	25-60	Silty clay, clay	CH, MH	A-7	0	100	90-100	90-100	75-95	50-70	20-40
Croswell--------	0-4	Sand-------------	SP-SM, SM	A-3, A-2-4, A-1-b	0	90-100	85-100	40-70	5-15	---	NP
	4-10	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	90-100	85-100	40-75	3-30	---	NP
	10-29	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	90-100	85-100	40-75	3-30	---	NP
	29-80	Sand-------------	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	90-100	85-100	40-70	3-15	---	NP
262A------------- Au Gres	0-10	Sand-------------	SM, SP-SM, SP	A-2-4, A-3, A-1-b	0	95-100	95-100	35-70	0-15	---	NP
	10-27	Sand, loamy sand	SP-SM, SM, SC-SM, SP	A-2-4, A-3, A-1-b	0	95-100	95-100	35-75	0-30	---	NP
	27-60	Sand-------------	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	95-100	95-100	35-70	0-15	---	NP
263A. Alfic Haplaquods											
264A------------- Allendale	0-11	Loamy sand-------	SM, SP-SM	A-2-4, A-1-b	0	95-100	90-100	45-80	10-30	---	NP
	11-25	Sand, loamy sand	SM, SP-SM	A-2-4, A-3, A-4, A-1-b	0	95-100	90-100	45-80	5-30	---	NP
	25-60	Silty clay, clay	CH, MH	A-7	0	100	90-100	90-100	75-95	50-70	20-40
272:											
Haplaquods.											
Fluvaquents.											
273:											
Leafriver-------	0-9	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	9-21	Loamy sand-------	SM, SP-SM	A-2-4	0	100	75-100	35-75	15-30	---	NP
	21-60	Sand-------------	SM, SP-SM, SP	A-3, A-2, A-2-4, A-1	0	95-100	70-100	35-70	3-15	---	NP
Wakeley---------	0-6	Mucky sand-------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	75-100	35-70	0-15	---	NP
	6-29	Sand, loamy sand	SP, SP-SM, SM, SC-SM	A-2-4, A-3	0-5	95-100	75-100	35-75	0-30	---	NP
	29-60	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	95-100	90-100	85-100	75-95	40-65	20-40

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
274. Typic Haplaquods											
280: Aquents.											
Histosols.											
281, 282. Borosaprists											

Table 18.--Physical and Chemical Properties of the Soils

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
11B-------------- Eastport	0-8	0-10	1.40-1.60	6.0-20	0.07-0.09	5.1-7.3	Low-----------	0.15	5	1	1-2
	8-29	0-10	1.40-1.60	6.0-20	0.06-0.08	5.1-7.8	Low-----------	0.15			
	29-80	0-4	1.40-1.55	6.0-20	0.03-0.06	6.6-8.4	Low-----------	0.15			
12B:											
Tawas-----------	0-5	---	0.30-0.55	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----	4	2	40-60
	5-17	---	0.30-0.55	0.2-6.0	0.24-0.45	4.5-7.8	-------------	----			
	17-60	0-10	1.40-1.65	6.0-20	0.05-0.07	5.6-8.4	Low-----------	0.15			
Au Gres---------	0-10	0-8	1.30-1.55	6.0-20	0.07-0.10	3.6-7.3	Low-----------	0.10	5	1	2-4
	10-27	1-10	1.50-1.70	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.10			
	27-60	0-8	1.50-1.70	6.0-20	0.05-0.07	5.1-7.3	Low-----------	0.10			
16B, 16C, 16D, 16E------------- Graycalm	0-1	0-10	1.30-1.55	6.0-20	0.04-0.10	4.5-6.5	Low-----------	0.10	5	1	.5-2
	1-46	0-15	1.25-1.60	6.0-20	0.05-0.10	4.5-7.3	Low-----------	0.10			
	46-80	0-10	1.50-1.65	6.0-20	0.04-0.09	4.5-7.3	Low-----------	0.10			
17B-------------- Croswell	0-4	0-10	1.30-1.55	6.0-20	0.06-0.09	3.6-6.5	Low-----------	0.10	5	1	.5-2
	4-10	0-10	1.40-1.60	6.0-20	0.06-0.10	4.5-7.3	Low-----------	0.10			
	10-29	0-10	1.40-1.60	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.10			
	29-80	0-10	1.50-1.65	6.0-20	0.05-0.07	5.1-8.4	Low-----------	0.10			
18A-------------- Au Gres	0-10	0-8	1.30-1.55	6.0-20	0.07-0.10	3.6-7.3	Low-----------	0.10	5	1	2-4
	10-27	1-10	1.50-1.70	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.10			
	27-60	0-8	1.50-1.70	6.0-20	0.05-0.07	5.1-7.3	Low-----------	0.10			
19--------------- Leafriver	0-9	---	0.10-0.25	0.6-6.0	0.35-0.50	5.6-7.3	-------------	----	2	2	50-90
	9-21	3-15	1.40-1.65	6.0-20	0.08-0.14	5.6-7.3	Low-----------	0.17			
	21-60	0-10	1.50-1.65	6.0-20	0.03-0.08	5.6-7.3	Low-----------	0.17			
26B-------------- Croswell	0-6	0-5	1.35-1.75	6.0-20	0.06-0.09	4.5-6.0	Low-----------	0.15	5	1	.5-2
	6-35	0-10	1.35-1.75	6.0-20	0.06-0.10	5.1-6.5	Low-----------	0.15			
	35-50	0-5	1.45-1.70	6.0-20	0.04-0.06	5.1-6.5	Low-----------	0.15			
	50-60	10-35	1.30-1.90	0.2-0.6	0.10-0.21	5.1-7.8	Low-----------	0.24			
27A-------------- Au Gres	0-15	1-6	1.35-1.65	6.0-20	0.06-0.09	4.5-6.5	Low-----------	0.15	5	1	1-2
	15-44	1-10	1.30-1.65	6.0-20	0.05-0.12	4.5-6.5	Low-----------	0.15			
	44-58	1-3	1.35-1.65	6.0-20	0.05-0.08	4.5-6.5	Low-----------	0.15			
	58-80	40-60	1.60-1.70	<0.06	0.08-0.12	6.6-7.8	High----------	0.32			
28B, 28C, 28E---- East Lake	0-4	0-8	1.30-1.60	6.0-20	0.05-0.09	5.6-7.3	Low-----------	0.15	4	1	.5-2
	4-30	0-10	1.30-1.60	6.0-20	0.07-0.10	5.6-7.3	Low-----------	0.15			
	30-60	0-10	1.50-1.65	>20	0.02-0.06	7.4-8.4	Low-----------	0.10			
29A-------------- Battlefield	0-9	0-10	1.25-1.45	6.0-20	0.07-0.09	4.5-6.0	Low-----------	0.10	4	1	1-3
	9-10	0-15	1.40-1.60	6.0-20	0.06-0.12	4.5-6.0	Low-----------	0.10			
	10-33	0-15	1.40-1.60	6.0-20	0.06-0.11	4.5-7.8	Low-----------	0.10			
	33-60	0-5	1.50-1.65	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
30--------------- Wheatley	0-5	---	0.30-0.40	0.2-6.0	0.35-0.45	6.1-7.8	Low-----------	----	3	2	40-70
	5-34	2-10	1.45-1.70	6.0-20	0.06-0.08	6.1-7.8	Low-----------	0.15			
	34-60	0-10	1.55-1.70	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			

Table 18.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
31B, 31C, 31D, 31E---------------	0-3	2-12	1.35-1.65	6.0-20	0.08-0.11	4.5-6.0	Low------------	0.15	5	2	1-2
Klacking	3-27	0-10	1.35-1.65	6.0-20	0.05-0.08	4.5-7.3	Low------------	0.10			
	27-60	2-15	1.55-1.70	2.0-6.0	0.05-0.11	4.5-7.3	Low------------	0.15			
33B, 33C, 33D, 33E---------------	0-5	0-10	1.35-1.65	2.0-6.0	0.08-0.12	5.1-7.3	Low------------	0.17	4	2	.5-3
Mancelona	5-31	2-15	1.30-1.65	6.0-20	0.06-0.12	5.6-7.8	Low------------	0.17			
	31-39	10-25	1.30-1.65	2.0-6.0	0.06-0.16	6.1-7.8	Low------------	0.17			
	39-60	0-10	1.45-1.65	>20	0.02-0.04	7.4-8.4	Low------------	0.10			
35-----------------	0-3	---	0.10-0.35	2.0-20	0.35-0.45	3.6-5.0	---------------	----	5	2	20-70
Kinross	3-26	0-10	1.40-1.70	6.0-20	0.04-0.09	3.6-6.0	Low------------	0.15			
	26-60	0-10	1.40-1.70	6.0-20	0.04-0.06	4.5-6.5	Low------------	0.15			
36B, 36C----------	0-3	2-15	1.10-1.60	0.6-6.0	0.10-0.14	4.5-7.3	Low------------	0.17	5	2	1-3
Alcona	3-12	5-15	1.25-1.70	0.6-6.0	0.10-0.17	4.5-7.3	Low------------	0.17			
	12-21	5-15	1.35-1.70	0.6-6.0	0.08-0.17	5.1-7.8	Low------------	0.17			
	21-41	10-20	1.35-1.70	0.6-2.0	0.13-0.20	5.1-7.8	Low------------	0.24			
	41-60	5-18	1.50-1.70	0.6-2.0	0.08-0.20	5.1-7.8	Low------------	0.24			
37A---------------	0-12	0-10	1.20-1.50	2.0-6.0	0.10-0.12	5.6-7.3	Low------------	0.17	5	2	2-4
Richter	12-37	10-22	1.35-1.60	0.6-2.0	0.10-0.18	5.6-7.3	Low------------	0.20			
	37-60	2-15	1.60-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low------------	0.20			
38-----------------	0-6	10-20	1.10-1.50	2.0-6.0	0.20-0.24	5.6-7.8	Low------------	0.32	4	5	4-7
Tonkey	6-26	8-18	1.30-1.80	2.0-6.0	0.10-0.15	5.6-7.8	Low------------	0.24			
	26-60	0-20	1.60-1.80	2.0-6.0	0.05-0.19	7.4-8.4	Low------------	0.24			
39B, 39C----------	0-7	2-10	1.35-1.60	2.0-6.0	0.09-0.12	5.1-7.3	Low------------	0.17	3	2	1-3
Glennie	7-20	5-15	1.35-1.70	2.0-6.0	0.10-0.14	5.1-7.3	Low------------	0.24			
	20-40	5-27	1.35-1.70	<0.06	0.09-0.18	5.6-7.3	Low------------	0.37			
	40-46	5-27	1.80-2.10	<0.06	0.03-0.04	5.6-7.3	Low------------	0.37			
	46-56	20-55	1.80-2.10	<0.06	0.03-0.04	5.6-7.3	High-----------	0.37			
	56-99	15-40	1.80-2.10	<0.06	0.03-0.04	7.4-8.4	Moderate-------	0.37			
40A---------------	0-5	5-18	1.20-1.50	0.6-2.0	0.13-0.15	5.1-6.0	Low------------	0.28	3	3	2-4
Sprinkler	5-13	5-18	1.35-1.60	0.6-2.0	0.12-0.14	5.1-6.0	Low------------	0.28			
	13-28	15-35	1.65-1.80	0.2-0.6	0.03-0.05	5.1-6.0	Moderate-------	0.37			
	28-44	18-35	1.65-1.80	0.2-0.6	0.03-0.05	5.1-6.0	Moderate-------	0.37			
	44-60	18-35	1.50-1.70	0.6-2.0	0.03-0.05	7.9-8.4	Moderate-------	0.37			
41B, 41C, 41D-----	0-2	0-5	1.25-1.40	2.0-6.0	0.11-0.14	5.1-5.5	Low------------	0.17	5	2	1-3
McGinn	2-4	0-5	1.30-1.65	2.0-6.0	0.10-0.12	4.5-5.5	Low------------	0.17			
	4-16	0-5	1.30-1.65	2.0-6.0	0.09-0.11	5.1-5.5	Low------------	0.17			
	16-25	5-15	1.30-1.65	2.0-6.0	0.10-0.13	5.1-6.0	Low------------	0.17			
	25-35	15-20	1.50-1.75	0.6-2.0	0.12-0.14	5.6-6.5	Low------------	0.28			
	35-80	5-15	1.65-1.80	0.6-2.0	0.11-0.13	7.4-8.4	Low------------	0.28			
42A---------------	0-8	5-15	1.30-1.65	2.0-6.0	0.12-0.15	5.1-6.5	Low------------	0.24	4	3	2-4
Killmaster	8-13	3-12	1.40-1.70	2.0-6.0	0.10-0.14	5.6-6.5	Low------------	0.24			
	13-23	5-15	1.40-1.70	2.0-6.0	0.09-0.14	6.1-6.5	Low------------	0.24			
	23-32	10-18	1.50-1.75	0.6-2.0	0.11-0.15	6.6-7.8	Low------------	0.24			
	32-80	5-15	1.80-2.00	<0.06	0.03-0.04	7.4-8.4	Low------------	0.24			
43-----------------	0-6	0-10	1.00-1.20	6.0-20	0.15-0.20	5.6-7.8	Low------------	0.10	4	1	10-15
Wakeley	6-29	0-15	1.45-1.60	6.0-20	0.05-0.10	5.6-7.8	Low------------	0.10			
	29-60	35-60	1.50-1.70	<0.06	0.08-0.12	7.4-8.4	High-----------	0.32			

Table 18.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
44B---------------Bamfield	0-6	5-20	1.30-1.60	2.0-6.0	0.14-0.18	4.5-5.0	Low-----------	0.24	4	3	1-3
	6-11	5-20	1.35-1.70	2.0-6.0	0.11-0.17	5.1-5.5	Low-----------	0.24			
	11-18	5-20	1.60-1.80	0.6-2.0	0.11-0.17	5.1-5.5	Low-----------	0.24			
	18-31	27-40	1.35-1.65	0.2-0.6	0.13-0.19	5.6-8.4	Moderate------	0.37			
	31-60	27-35	1.70-2.00	<0.06	0.03-0.04	7.9-8.4	Moderate------	0.37			
45B, 45C---------Hoist	0-9	5-15	1.30-1.65	2.0-6.0	0.12-0.15	5.6-7.3	Low-----------	0.24	4	3	1-3
	9-14	5-15	1.40-1.70	2.0-6.0	0.10-0.14	5.6-7.3	Low-----------	0.24			
	14-21	5-15	1.40-1.70	2.0-6.0	0.09-0.14	6.1-7.3	Low-----------	0.24			
	21-27	15-18	1.50-1.75	0.2-0.6	0.11-0.18	6.6-7.8	Low-----------	0.32			
	27-49	5-15	1.60-1.80	0.2-0.6	0.11-0.15	7.4-8.4	Low-----------	0.24			
	49-80	5-15	1.80-2.00	<0.06	0.03-0.04	7.4-8.4	Low-----------	0.28			
46----------------Ensley	0-8	10-20	1.10-1.30	2.0-6.0	0.17-0.22	6.1-7.8	Low-----------	0.24	5	5	10-15
	8-29	10-25	1.30-1.70	0.6-2.0	0.11-0.18	6.6-8.4	Low-----------	0.24			
	29-60	8-18	1.45-1.70	0.6-2.0	0.10-0.14	7.4-8.4	Low-----------	0.20			
53B, 53C---------Negwegon	0-8	12-27	1.40-1.60	0.6-2.0	0.22-0.24	6.1-7.8	Low-----------	0.37	3	5	1-3
	8-46	35-60	1.40-1.70	<0.06	0.11-0.20	6.1-7.8	High----------	0.32			
	46-60	35-60	1.40-1.70	<0.06	0.11-0.20	7.9-8.4	High----------	0.32			
54A---------------Algonquin	0-7	15-27	1.20-1.55	0.6-2.0	0.22-0.24	6.6-7.3	Low-----------	0.37	3	6	2-3
	7-14	35-60	1.40-1.60	0.06-0.2	0.11-0.20	7.4-8.4	High----------	0.32			
	14-29	35-60	1.40-1.60	<0.06	0.11-0.20	7.9-8.4	High----------	0.32			
	29-60	35-60	1.40-1.70	<0.06	0.11-0.20	7.9-8.4	High----------	0.32			
55----------------Springport	0-8	27-40	1.25-1.50	0.2-0.6	0.17-0.19	6.6-7.3	Moderate------	0.32	3	6	2-5
	8-12	35-60	1.40-1.65	0.06-0.2	0.11-0.20	7.4-8.4	High----------	0.32			
	12-27	35-60	1.40-1.70	<0.06	0.11-0.20	7.4-8.4	High----------	0.32			
	27-60	35-60	1.40-1.70	<0.06	0.11-0.20	7.4-8.4	High----------	0.32			
56B, 56C---------Nester	0-9	7-27	1.25-1.60	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.32	3	5	1-3
	9-14	5-25	1.25-1.60	0.6-2.0	0.15-0.22	5.1-7.3	Low-----------	0.32			
	14-40	35-45	1.40-1.60	0.06-0.2	0.08-0.17	5.1-7.3	Moderate------	0.32			
	40-60	30-40	1.40-1.65	0.06-0.2	0.10-0.17	7.9-8.4	Moderate------	0.32			
57B---------------Kawkawlin	0-10	8-27	1.45-1.60	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.37	3	5	2-4
	10-16	35-45	1.45-1.60	0.06-0.2	0.10-0.20	5.1-7.8	Moderate------	0.32			
	16-60	30-40	1.50-1.60	0.06-0.2	0.13-0.20	7.9-8.4	Moderate------	0.32			
59B:											
Algonquin---------	0-7	15-27	1.20-1.55	0.6-2.0	0.22-0.24	6.6-7.3	Low-----------	0.37	3	6	2-3
	7-14	35-60	1.40-1.60	0.06-0.2	0.11-0.20	7.4-8.4	High----------	0.32			
	14-29	35-60	1.40-1.60	<0.06	0.11-0.20	7.9-8.4	High----------	0.32			
	29-60	35-60	1.40-1.70	<0.06	0.11-0.20	7.9-8.4	High----------	0.32			
Springport--------	0-8	27-40	1.25-1.50	0.2-0.6	0.17-0.19	6.6-7.3	Moderate------	0.32	3	6	2-5
	8-12	35-60	1.40-1.65	0.06-0.2	0.11-0.20	7.4-8.4	High----------	0.32			
	12-27	35-60	1.40-1.70	<0.06	0.11-0.20	7.4-8.4	High----------	0.32			
	27-60	35-60	1.40-1.70	<0.06	0.11-0.20	7.4-8.4	High----------	0.32			
60D, 60E---------Glennie	0-7	2-5	1.35-1.60	2.0-6.0	0.09-0.12	5.1-7.3	Low-----------	0.17	3	2	1-3
	7-20	5-15	1.35-1.70	2.0-6.0	0.10-0.14	5.1-7.3	Low-----------	0.24			
	20-40	5-27	1.35-1.70	<0.06	0.09-0.18	5.6-7.3	Low-----------	0.37			
	40-46	5-27	1.80-2.10	<0.06	0.03-0.04	5.6-7.3	Low-----------	0.37			
	46-56	20-55	1.80-2.10	<0.06	0.03-0.04	5.6-7.3	High----------	0.37			
	56-99	15-40	1.80-2.10	<0.06	0.03-0.04	7.4-8.4	Moderate------	0.37			

Table 18.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
61C, 61D, 61F----- Manistee	0-6	3-12	1.35-1.60	6.0-20	0.10-0.12	4.5-7.3	Low----------	0.17	4	2	2-4
	6-24	2-12	1.35-1.60	6.0-20	0.06-0.10	5.1-7.3	Low----------	0.17			
	24-50	35-60	1.50-1.70	<0.06	0.08-0.12	5.1-7.3	High---------	0.32			
	50-60	35-60	1.60-1.75	0.06-0.2	0.08-0.16	6.6-8.4	High---------	0.32			
62A-------------- Allendale	0-11	0-12	1.25-1.40	6.0-20	0.09-0.12	4.5-7.3	Low----------	0.17	4	2	2-4
	11-25	0-15	1.35-1.45	6.0-20	0.06-0.10	4.5-7.3	Low----------	0.17			
	25-60	40-60	1.45-1.70	<0.06	0.08-0.12	6.1-8.4	High---------	0.32			
63C, 63D, 63F----- Bamfield	0-6	5-20	1.30-1.60	2.0-6.0	0.14-0.18	4.5-5.0	Low----------	0.24	4	3	1-3
	6-11	5-20	1.35-1.70	2.0-6.0	0.11-0.17	5.1-5.5	Low----------	0.24			
	11-18	5-20	1.60-1.80	0.6-2.0	0.11-0.17	5.1-5.5	Low----------	0.24			
	18-31	27-40	1.35-1.65	0.2-0.6	0.13-0.19	5.6-8.4	Moderate-----	0.37			
	31-60	27-35	1.70-2.00	<0.06	0.03-0.04	7.9-8.4	Moderate-----	0.37			
66D, 66E--------- Alcona	0-3	2-15	1.30-1.60	0.6-6.0	0.10-0.14	4.5-7.3	Low----------	0.17	5	2	1-3
	3-12	5-20	1.35-1.70	0.6-6.0	0.10-0.17	4.5-7.3	Low----------	0.20			
	12-21	5-18	1.35-1.70	0.6-6.0	0.08-0.17	5.1-7.8	Low----------	0.15			
	21-41	10-20	1.35-1.70	0.6-2.0	0.13-0.20	5.1-7.8	Low----------	0.24			
	41-60	5-18	1.50-1.70	0.6-2.0	0.08-0.20	5.1-7.8	Low----------	0.24			
68--------------- Rondeau	0-19	---	0.10-0.25	0.2-6.0	0.35-0.48	5.1-7.8	-------------	----	5	2	>25
	19-60	5-15	0.05-0.20	<0.2	0.20-0.22	7.4-8.4	-------------	----			
69--------------- Loxley	0-18	---	0.30-0.40	>6.0	0.35-0.65	<4.5	-------------	----	5	7	70-90
	18-60	---	0.10-0.35	0.2-6.0	0.35-0.45	<4.5	-------------	----			
70--------------- Lupton	0-5	---	0.10-0.35	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	5	2	70-90
	5-60	---	0.10-0.35	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----			
71--------------- Tawas	0-5	---	0.30-0.55	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----	4	2	40-60
	5-17	---	0.30-0.55	0.2-6.0	0.24-0.45	4.5-7.8	-------------	----			
	17-60	0-10	1.40-1.65	6.0-20	0.03-0.10	5.6-8.4	Low----------	0.15			
72--------------- Dorval	0-27	---	0.13-0.42	0.6-6.0	0.20-0.25	5.1-7.8	-------------	----	2	2	50-95
	27-60	35-60	1.40-1.65	<0.06	0.10-0.20	6.1-8.4	High---------	0.28			
73--------------- Markey	0-28	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	4	2	55-85
	28-60	0-10	1.40-1.65	6.0-20	0.03-0.08	5.6-8.4	Low----------	0.10			
74C2------------- Negwegon	0-8	27-40	1.40-1.60	0.2-0.6	0.21-0.23	6.1-7.8	Moderate-----	0.37	3	7	.5-2
	8-40	35-60	1.40-1.70	<0.06	0.11-0.20	6.1-7.8	High---------	0.32			
	40-60	35-60	1.40-1.70	<0.06	0.11-0.20	7.9-8.4	High---------	0.32			
77--------------- Waucedah	0-9	---	0.30-0.40	0.2-6.0	0.35-0.45	6.1-7.3	-------------	----	5	2	40-70
	9-13	12-20	1.40-1.60	0.6-2.0	0.20-0.22	6.1-8.4	Low----------	0.37			
	13-18	12-20	1.40-1.60	0.6-2.0	0.20-0.22	6.1-8.4	Low----------	0.37			
	18-55	5-15	1.40-1.65	0.6-2.0	0.09-0.12	6.1-8.4	Low----------	0.28			
	55-60	40-60	1.40-1.60	<0.06	0.10-0.12	6.1-8.4	Low----------	0.28			
78. Pits											
80F:											
Zimmerman--------	0-4	2-12	1.27-1.56	6.0-20	0.10-0.12	4.5-6.5	Low----------	0.17	5	2	1-2
	4-80	0-12	1.60-1.70	6.0-20	0.06-0.10	6.1-7.3	Low----------	0.17			

Table 18.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
80F:											
Alcona----------	0-3	2-15	1.30-1.60	0.6-6.0	0.10-0.14	4.5-7.3	Low----------	0.17	5	2	1-3
	3-12	5-20	1.35-1.70	0.6-6.0	0.10-0.17	4.5-7.3	Low----------	0.20			
	12-21	5-18	1.35-1.70	0.6-6.0	0.08-0.17	5.1-7.8	Low----------	0.15			
	21-41	10-20	1.35-1.70	0.6-2.0	0.13-0.20	5.1-7.8	Low----------	0.24			
	41-60	5-18	1.50-1.70	0.6-2.0	0.08-0.20	5.1-7.8	Low----------	0.24			
81B, 81C, 81E---- Grayling	0-2	0-10	1.30-1.65	6.0-20	0.07-0.09	3.6-5.5	Low----------	0.15	5	1	1-6
	2-29	0-10	1.30-1.65	6.0-20	0.06-0.08	3.6-5.5	Low----------	0.15			
	29-63	0-10	1.45-1.65	6.0-20	0.04-0.06	4.5-6.5	Low----------	0.15			
	63-80	0-10	1.45-1.65	6.0-20	0.04-0.06	5.6-8.4	Low----------	0.15			
82C. Udorthents											
83F. Udipsamments											
84B, 84C, 84D---- Zimmerman	0-4	2-12	1.27-1.56	6.0-20	0.10-0.12	4.5-6.5	Low----------	0.17	5	2	1-2
	4-80	0-12	1.60-1.70	6.0-20	0.06-0.10	6.1-7.3	Low----------	0.17			
85B, 85D:											
Zimmerman-------	0-4	2-12	1.27-1.56	6.0-20	0.10-0.12	4.5-6.5	Low----------	0.17	5	2	1-2
	4-80	0-12	1.60-1.70	6.0-20	0.06-0.10	6.1-7.3	Low----------	0.17			
Alcona----------	0-3	2-15	1.10-1.60	0.6-6.0	0.10-0.14	4.5-7.3	Low----------	0.17	5	2	1-3
	3-12	5-15	1.25-1.70	0.6-6.0	0.10-0.17	4.5-7.3	Low----------	0.17			
	12-21	5-15	1.35-1.70	0.6-6.0	0.08-0.17	5.1-7.8	Low----------	0.17			
	21-41	10-20	1.35-1.70	0.6-2.0	0.13-0.20	5.1-7.8	Low----------	0.24			
	41-60	5-18	1.50-1.70	0.6-2.0	0.08-0.20	5.1-7.8	Low----------	0.24			
86:											
Histosols.											
Aquents.											
87--------------- Ausable	0-8	---	0.20-0.30	0.6-6.0	0.35-0.45	6.1-7.3	-------------	----	5	2	70-90
	8-17	0-10	1.40-1.65	6.0-20	0.06-0.10	6.1-7.8	Low----------	0.10			
	17-60	0-10	1.30-1.60	6.0-20	0.04-0.08	6.1-7.8	Low----------	0.15			
88D-------------- Hoist	0-9	5-15	1.30-1.65	2.0-6.0	0.12-0.15	5.6-7.3	Low----------	0.24	4	3	1-3
	9-14	5-15	1.40-1.70	2.0-6.0	0.10-0.14	5.6-7.3	Low----------	0.24			
	14-21	5-15	1.40-1.70	2.0-6.0	0.09-0.14	6.1-7.3	Low----------	0.24			
	21-27	15-18	1.50-1.75	0.6-2.0	0.11-0.18	6.6-7.8	Moderate-----	0.32			
	27-49	5-15	1.60-1.80	0.6-2.0	0.11-0.15	7.4-8.4	Low----------	0.24			
	49-80	5-15	1.80-2.00	<0.06	0.03-0.04	7.4-8.4	Low----------	0.28			
89F:											
Bamfield--------	0-6	5-20	1.30-1.60	2.0-6.0	0.14-0.18	4.5-5.0	Low----------	0.24	4	3	1-3
	6-11	5-20	1.35-1.70	2.0-6.0	0.11-0.17	5.1-5.5	Low----------	0.24			
	11-18	5-20	1.60-1.80	0.6-2.0	0.11-0.17	5.1-5.5	Low----------	0.24			
	18-31	27-40	1.35-1.65	0.2-0.6	0.13-0.19	5.6-8.4	Moderate-----	0.37			
	31-60	27-35	1.70-2.00	<0.06	0.03-0.04	7.9-8.4	Moderate-----	0.37			
Lupton----------	0-5	---	0.10-0.35	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	5	8	70-90
	5-60	---	0.10-0.35	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----			

Table 18.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
90B-------------- Chinwhisker	0-3	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low-----------	0.10	5	1	.5-2
	3-8	0-10	1.30-1.55	6.0-20	0.06-0.08	4.5-6.0	Low-----------	0.10			
	8-21	0-10	1.30-1.55	6.0-20	0.06-0.08	4.5-6.5	Low-----------	0.10			
	21-36	0-5	1.30-1.55	6.0-20	0.05-0.07	4.5-7.3	Low-----------	0.10			
	36-80	3-10	1.50-1.65	6.0-20	0.05-0.10	5.6-8.4	Low-----------	0.10			
91E:											
Glennie---------	0-7	2-5	1.35-1.60	2.0-6.0	0.09-0.12	5.1-7.3	Low-----------	0.17	3	2	1-3
	7-20	5-15	1.35-1.70	2.0-6.0	0.10-0.14	5.1-7.3	Low-----------	0.24			
	20-40	5-27	1.35-1.70	<0.06	0.09-0.18	5.6-7.3	Low-----------	0.37			
	40-46	5-27	1.80-2.10	<0.06	0.03-0.04	5.6-7.3	Low-----------	0.37			
	46-56	20-55	1.80-2.10	<0.06	0.03-0.04	5.6-7.3	High----------	0.37			
	56-99	15-40	1.80-2.10	<0.06	0.03-0.04	7.4-8.4	Moderate------	0.37			
Lupton----------	0-5	---	0.10-0.35	0.2-6.0	0.35-0.45	5.6-7.8	--------------	----	5	8	70-90
	5-60	---	0.10-0.35	0.2-6.0	0.35-0.45	5.6-7.8	--------------	----			
92B:											
Klacking--------	0-3	2-12	1.35-1.65	6.0-20	0.08-0.11	4.5-6.0	Low-----------	0.15	5	2	1-2
	3-27	0-10	1.35-1.65	6.0-20	0.05-0.08	4.5-7.3	Low-----------	0.10			
	27-60	2-15	1.55-1.70	2.0-6.0	0.05-0.11	4.5-7.3	Low-----------	0.15			
McGinn----------	0-2	0-5	1.25-1.40	2.0-6.0	0.11-0.14	5.1-5.5	Low-----------	0.17	5	2	1-3
	2-4	0-5	1.30-1.65	2.0-6.0	0.10-0.12	4.5-5.5	Low-----------	0.17			
	4-16	0-5	1.30-1.65	2.0-6.0	0.09-0.11	5.1-5.5	Low-----------	0.17			
	16-25	5-15	1.30-1.65	2.0-6.0	0.10-0.13	5.1-6.0	Low-----------	0.17			
	25-35	15-20	1.50-1.75	0.6-2.0	0.12-0.14	5.6-6.5	Low-----------	0.28			
	35-80	5-15	1.65-1.80	0.6-2.0	0.11-0.13	7.4-8.4	Low-----------	0.28			
93B:											
Au Gres---------	0-15	1-6	1.35-1.65	6.0-20	0.06-0.09	4.5-6.5	Low-----------	0.15	5	1	1-2
	15-44	1-15	1.30-1.65	6.0-20	0.05-0.12	4.5-6.5	Low-----------	0.15			
	44-58	1-3	1.35-1.65	6.0-20	0.05-0.08	4.5-6.5	Low-----------	0.15			
	58-80	40-60	1.60-1.70	<0.06	0.08-0.12	6.6-7.8	High----------	0.32			
Wakeley---------	0-6	0-10	1.00-1.20	6.0-20	0.15-0.20	5.6-7.8	Low-----------	0.10	4	1	10-15
	6-29	0-15	1.45-1.60	6.0-20	0.05-0.10	5.6-7.8	Low-----------	0.10			
	29-60	35-60	1.50-1.70	<0.06	0.08-0.12	7.4-8.4	High----------	0.32			
94F:											
Klacking--------	0-3	2-12	1.35-1.65	6.0-20	0.08-0.11	4.5-6.0	Low-----------	0.15	5	2	1-2
	3-27	0-10	1.35-1.65	6.0-20	0.05-0.08	4.5-7.3	Low-----------	0.10			
	27-60	2-15	1.55-1.70	2.0-6.0	0.05-0.11	4.5-7.3	Low-----------	0.15			
McGinn----------	0-2	0-5	1.25-1.40	2.0-6.0	0.11-0.14	5.1-5.5	Low-----------	0.17	5	2	1-3
	2-4	0-5	1.30-1.65	2.0-6.0	0.10-0.12	4.5-5.5	Low-----------	0.17			
	4-16	0-5	1.30-1.65	2.0-6.0	0.09-0.11	5.1-5.5	Low-----------	0.17			
	16-25	5-15	1.30-1.65	2.0-6.0	0.10-0.13	5.1-6.0	Low-----------	0.17			
	25-35	15-20	1.50-1.75	0.6-2.0	0.12-0.14	5.6-6.5	Low-----------	0.28			
	35-80	5-15	1.65-1.80	0.6-2.0	0.11-0.13	7.4-8.4	Low-----------	0.28			
96D2------------- Negwegon	0-6	27-40	1.40-1.60	0.2-0.6	0.21-0.23	6.1-7.8	Moderate------	0.37	3	7	.5-2
	6-40	35-60	1.40-1.70	<0.06	0.11-0.20	6.1-7.8	High----------	0.32			
	40-60	35-60	1.40-1.70	<0.06	0.11-0.20	7.9-8.4	High----------	0.32			
97--------------- Colonville	0-11	10-15	1.35-1.45	2.0-6.0	0.20-0.22	6.6-8.4	Low-----------	0.28	3	3	2-4
	11-60	0-18	1.40-1.65	2.0-6.0	0.02-0.12	7.9-8.4	Low-----------	0.15			
98C-------------- Graycalm	0-1	0-10	1.30-1.55	6.0-20	0.04-0.10	4.5-6.5	Low-----------	0.10	5	1	.5-2
	1-46	0-15	1.25-1.60	6.0-20	0.05-0.10	4.5-7.3	Low-----------	0.10			
	46-80	0-10	1.50-1.65	6.0-20	0.04-0.09	4.5-7.3	Low-----------	0.10			

Table 18.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
102D, 102E, 102F-- Nester	0-9	7-27	1.25-1.60	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.32	3	5	1-3
	9-14	5-25	1.40-1.60	0.6-2.0	0.15-0.22	5.1-7.3	Low----------	0.32			
	14-25	35-45	1.40-1.65	0.06-0.2	0.08-0.17	5.1-7.3	Moderate-----	0.32			
	25-60	30-40	1.55-1.70	0.06-0.2	0.10-0.17	7.9-8.4	Moderate-----	0.32			
110D-------------- Negwegon	0-8	12-27	1.40-1.60	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.37	3	5	1-3
	8-46	35-60	1.40-1.70	<0.06	0.11-0.20	6.1-7.8	High---------	0.32			
	46-60	35-60	1.40-1.70	<0.06	0.11-0.20	7.9-8.4	High---------	0.32			
110F-------------- Negwegon	0-4	12-27	1.40-1.60	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.37	3	5	1-3
	4-40	35-60	1.40-1.70	<0.06	0.11-0.20	6.1-7.8	High---------	0.32			
	40-60	35-60	1.40-1.70	<0.06	0.11-0.20	7.9-8.4	High---------	0.32			
111B-------------- Manistee	0-6	3-12	1.35-1.60	6.0-20	0.10-0.12	4.5-7.3	Low----------	0.17	4	2	2-4
	6-24	2-12	1.35-1.60	6.0-20	0.06-0.10	5.1-7.3	Low----------	0.17			
	24-50	35-60	1.50-1.70	<0.06	0.08-0.12	5.1-7.3	High---------	0.32			
	50-60	35-60	1.60-1.70	0.06-0.2	0.08-0.16	6.6-8.4	High---------	0.32			
209B-------------- Grayling	0-2	0-4	1.30-1.55	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15	5	1	1-5
	2-29	0-4	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	29-70	0-4	1.50-1.65	6.0-20	0.04-0.06	5.1-6.5	Low----------	0.15			
	70-180	0-4	1.50-1.65	6.0-20	0.04-0.12	7.4-8.4	Low----------	0.15			
210B, 210C, 210D-- Grayling	0-2	0-10	1.30-1.65	6.0-20	0.07-0.09	3.6-5.5	Low----------	0.15	5	1	1-6
	2-29	0-10	1.30-1.65	6.0-20	0.06-0.08	3.6-5.5	Low----------	0.15			
	29-63	0-10	1.45-1.65	6.0-20	0.04-0.06	4.5-6.5	Low----------	0.15			
	63-180	0-10	1.45-1.65	6.0-20	0.04-0.06	5.6-8.4	Low----------	0.15			
211B, 211C-------- Grayling	0-3	0-4	1.30-1.55	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15	5	1	1-5
	3-35	0-4	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	35-60	0-4	1.50-1.65	6.0-20	0.04-0.06	4.5-6.5	Low----------	0.15			
	60-180	0-20	1.55-1.70	0.6-20	0.04-0.12	4.5-6.5	Low----------	0.20			
212B-------------- Grayling	0-3	0-4	1.30-1.55	6.0-20	0.07-0.09	3.6-5.5	Low----------	0.15	5	1	1-5
	3-30	0-4	1.40-1.60	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15			
	30-180	0-4	1.50-1.65	6.0-20	0.04-0.06	4.5-6.5	Low----------	0.15			
213B, 213C-------- Graycalm	0-1	0-10	1.30-1.55	6.0-20	0.04-0.10	4.5-6.5	Low----------	0.10	5	1	.5-2
	1-46	0-15	1.25-1.60	6.0-20	0.05-0.10	4.5-7.3	Low----------	0.10			
	46-70	0-10	1.50-1.65	6.0-20	0.04-0.09	4.5-7.3	Low----------	0.10			
	70-180	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-8.4	Low----------	0.10			
215C-------------- Typic Udipsamments	0-2	0-4	1.30-1.55	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15	5	1	1-5
	2-25	0-4	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	25-75	0-4	1.50-1.65	6.0-20	0.04-0.06	4.5-6.5	Low----------	0.15			
	75-95	10-30	1.65-1.80	0.2-2.0	0.11-0.17	5.1-6.5	Low----------	0.28			
220B, 220C, 220D, 220E------------- Typic Udipsamments	0-2	0-4	1.30-1.55	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15	5	1	1-5
	2-40	0-4	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	40-180	0-4	1.50-1.65	6.0-20	0.04-0.06	4.5-6.5	Low----------	0.15			
221B, 221C, 221D-- Typic Udipsamments	0-3	0-4	1.30-1.55	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15	5	1	1-5
	3-30	0-4	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	30-45	0-4	1.50-1.65	6.0-20	0.04-0.06	4.5-6.5	Low----------	0.15			
	45-180	0-20	1.55-1.70	0.6-20	0.04-0.12	4.5-6.5	Low----------	0.20			

Table 18.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
222B-------------Typic Udipsamments	0-2	0-4	1.30-1.55	6.0-20	0.06-0.08	4.5-6.5	Low-----------	0.15	5	1	1-5
	2-30	0-4	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low-----------	0.15			
	30-180	0-4	1.50-1.65	6.0-20	0.04-0.06	4.5-6.5	Low-----------	0.15			
223B, 223C, 223D:											
Graycalm---------	0-1	0-10	1.30-1.55	6.0-20	0.04-0.10	4.5-6.5	Low-----------	0.10	5	1	.5-2
	1-46	0-15	1.25-1.60	6.0-20	0.05-0.10	4.5-7.3	Low-----------	0.10			
	46-70	0-10	1.50-1.65	6.0-20	0.04-0.09	4.5-7.3	Low-----------	0.10			
	70-180	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-8.4	Low-----------	0.10			
Grayling---------	0-2	0-10	1.30-1.65	6.0-20	0.07-0.09	3.6-5.5	Low-----------	0.15	5	1	1-6
	2-29	0-10	1.30-1.65	6.0-20	0.06-0.08	3.6-5.5	Low-----------	0.15			
	29-63	0-10	1.45-1.65	6.0-20	0.04-0.06	4.5-6.5	Low-----------	0.15			
	63-180	0-10	1.45-1.65	6.0-20	0.04-0.06	5.6-8.4	Low-----------	0.15			
224B-------------Croswell	0-4	0-10	1.30-1.55	6.0-20	0.06-0.09	3.6-6.5	Low-----------	0.10	5	1	.5-2
	4-10	0-10	1.40-1.60	6.0-20	0.06-0.10	4.5-7.3	Low-----------	0.10			
	10-29	0-10	1.40-1.60	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.10			
	29-80	0-10	1.50-1.65	6.0-20	0.05-0.07	5.1-8.4	Low-----------	0.10			
225B, 225C--------Entic Haplorthods	0-2	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low-----------	0.15	5	1	1-5
	2-30	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low-----------	0.15			
	30-55	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low-----------	0.15			
	55-80	20-40	1.30-1.65	0.2-0.6	0.14-0.16	5.6-8.4	Moderate------	0.37			
230C:											
Entic Haplorthods----	0-2	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.0	Low-----------	0.15	5	1	1-5
	2-35	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low-----------	0.15			
	35-180	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low-----------	0.15			
Alfic Haplorthods----	0-4	2-10	1.35-1.65	6.0-20	0.10-0.12	5.1-6.5	Low-----------	0.15	5	2	1-5
	4-37	0-10	1.35-1.65	6.0-20	0.06-0.10	5.1-6.5	Low-----------	0.10			
	37-42	10-22	1.50-1.70	0.2-2.0	0.11-0.18	5.1-6.5	Low-----------	0.24			
	42-180	0-10	1.55-1.70	6.0-20	0.04-0.10	6.1-7.3	Low-----------	0.10			
231B, 231C, 231D:											
Entic Haplorthods----	0-2	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low-----------	0.15	5	1	1-5
	2-30	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low-----------	0.15			
	30-60	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low-----------	0.15			
	60-180	0-20	1.55-1.70	0.6-20	0.07-0.10	5.6-7.3	Low-----------	0.17			
Alfic Haplorthods----	0-4	2-10	1.35-1.65	6.0-20	0.10-0.12	5.1-6.5	Low-----------	0.15	5	2	1-5
	4-37	0-10	1.35-1.65	6.0-20	0.06-0.10	5.1-6.5	Low-----------	0.10			
	37-42	10-22	1.50-1.70	0.2-2.0	0.11-0.18	5.1-6.5	Low-----------	0.24			
	42-180	0-10	1.55-1.70	6.0-20	0.04-0.10	6.1-7.3	Low-----------	0.10			
232B:											
Entic Haplorthods----	0-2	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.0	Low-----------	0.15	5	1	1-5
	2-30	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low-----------	0.15			
	30-100	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low-----------	0.15			

Table 18.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
232B:											
Alfic Haplorthods----	0-4	2-10	1.35-1.65	6.0-20	0.10-0.12	5.1-6.5	Low----------	0.15	5	2	1-5
	4-37	0-10	1.35-1.65	6.0-20	0.06-0.10	5.1-6.5	Low----------	0.15			
	37-42	10-22	1.50-1.70	0.2-2.0	0.11-0.18	5.1-6.5	Low----------	0.24			
	42-100	0-10	1.55-1.70	6.0-20	0.04-0.10	6.1-7.3	Low----------	0.10			
233B, 233C, 233D:											
Alfic Haplorthods----	0-4	2-10	1.35-1.65	6.0-20	0.10-0.12	5.1-6.5	Low----------	0.15	5	2	1-5
	4-37	0-10	1.35-1.65	6.0-20	0.06-0.10	5.1-6.5	Low----------	0.10			
	37-42	10-22	1.50-1.70	0.2-2.0	0.11-0.18	5.1-6.5	Low----------	0.24			
	42-180	0-10	1.55-1.70	6.0-20	0.04-0.10	6.1-7.3	Low----------	0.10			
Entic Haplorthods----	0-2	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low----------	0.15	5	1	1-5
	2-30	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	30-55	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low----------	0.15			
	55-180	0-35	1.50-1.70	0.2-20	0.04-0.17	5.6-7.3	Moderate-----	0.28			
235B, 235C, 235D:											
Alfic Haplorthods, sandy over loamy----------	0-4	0-10	1.30-1.55	6.0-20	0.06-0.09	5.1-6.5	Low----------	0.15	5	1	1-3
	4-6	0-10	1.30-1.65	6.0-20	0.05-0.11	5.1-6.5	Low----------	0.15			
	6-27	0-10	1.30-1.65	6.0-20	0.05-0.11	5.1-6.5	Low----------	0.15			
	27-44	20-40	1.45-1.60	0.2-0.6	0.15-0.18	5.6-7.3	Moderate-----	0.32			
	44-120	0-15	1.55-1.70	2.0-20	0.04-0.13	6.1-7.8	Low----------	0.17			
Alfic Haplorthods, sandy----------	0-4	2-10	1.35-1.65	6.0-20	0.10-0.12	5.1-6.5	Low----------	0.15	5	2	1-5
	4-37	0-10	1.35-1.65	6.0-20	0.06-0.10	5.1-6.5	Low----------	0.10			
	37-42	10-22	1.50-1.70	0.2-2.0	0.11-0.18	5.1-6.5	Low----------	0.24			
	42-180	0-10	1.55-1.70	6.0-20	0.04-0.10	6.1-7.3	Low----------	0.10			
236B, 236C. Arenic Eutroboralfs											
237B, 237C, 237D. Glossic Eutroboralfs											
247B, 247C:											
Glennie---------	0-7	2-10	1.35-1.60	2.0-6.0	0.09-0.12	5.1-7.3	Low----------	0.17	3	2	1-3
	7-20	5-15	1.35-1.70	2.0-6.0	0.10-0.14	5.1-7.3	Low----------	0.24			
	20-40	5-27	1.35-1.70	<0.06	0.09-0.18	5.6-7.3	Low----------	0.37			
	40-46	5-27	1.80-2.10	<0.06	0.03-0.04	5.6-7.3	Low----------	0.37			
	46-56	20-55	1.80-2.10	<0.06	0.03-0.04	5.6-7.3	High---------	0.37			
	56-99	15-40	1.80-2.10	<0.06	0.03-0.04	7.4-8.4	Moderate-----	0.37			
Bamfield--------	0-6	5-20	1.30-1.60	2.0-6.0	0.14-0.18	4.5-5.0	Low----------	0.24	4	3	1-3
	6-11	5-20	1.35-1.70	2.0-6.0	0.11-0.17	5.1-5.5	Low----------	0.24			
	11-18	5-20	1.60-1.80	0.6-2.0	0.11-0.17	5.1-5.5	Low----------	0.24			
	18-31	27-40	1.35-1.65	0.2-0.6	0.13-0.19	5.6-8.4	Moderate-----	0.37			
	31-60	27-35	1.70-2.00	<0.06	0.03-0.04	7.9-8.4	Moderate-----	0.37			

Table 18.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
247D:											
Glennie---------	0-7	2-5	1.35-1.60	2.0-6.0	0.09-0.12	5.1-7.3	Low----------	0.17	3	2	1-3
	7-20	5-15	1.35-1.70	2.0-6.0	0.10-0.14	5.1-7.3	Low----------	0.24			
	20-40	5-27	1.35-1.70	<0.06	0.09-0.18	5.6-7.3	Low----------	0.37			
	40-46	5-27	1.80-2.10	<0.06	0.03-0.04	5.6-7.3	Low----------	0.37			
	46-56	20-55	1.80-2.10	<0.06	0.03-0.04	5.6-7.3	High---------	0.37			
	56-99	15-40	1.80-2.10	<0.06	0.03-0.04	7.4-8.4	Moderate-----	0.37			
Bamfield--------	0-6	5-20	1.30-1.60	2.0-6.0	0.14-0.18	4.5-5.0	Low----------	0.24	4	3	1-3
	6-11	5-20	1.35-1.70	2.0-6.0	0.11-0.17	5.1-5.5	Low----------	0.24			
	11-18	5-20	1.60-1.80	0.6-2.0	0.11-0.17	5.1-5.5	Low----------	0.24			
	18-31	27-40	1.35-1.65	0.2-0.6	0.13-0.19	5.6-8.4	Moderate-----	0.37			
	31-60	27-35	1.70-2.00	<0.06	0.03-0.04	7.9-8.4	Moderate-----	0.37			
250D:											
Glossic Eutroboralfs.											
Borosaprists.											
252A:											
Borosaprists.											
Au Gres---------	0-10	0-8	1.30-1.55	6.0-20	0.07-0.10	3.6-7.3	Low----------	0.10	5	1	2-4
	10-27	1-15	1.50-1.70	6.0-20	0.06-0.09	4.5-7.3	Low----------	0.10			
	27-60	0-8	1.50-1.70	6.0-20	0.05-0.07	5.1-7.3	Low----------	0.10			
253A:											
Au Gres---------	0-10	0-8	1.30-1.55	6.0-20	0.07-0.10	3.6-7.3	Low----------	0.10	5	1	2-4
	10-27	1-10	1.50-1.70	6.0-20	0.06-0.09	4.5-7.3	Low----------	0.10			
	27-60	0-8	1.50-1.70	6.0-20	0.05-0.07	5.1-7.3	Low----------	0.10			
Allendale-------	0-11	0-10	1.25-1.40	6.0-20	0.07-0.09	4.5-7.3	Low----------	0.15	4	1	2-4
	11-25	0-15	1.35-1.45	6.0-20	0.06-0.10	4.5-7.3	Low----------	0.17			
	25-60	40-60	1.45-1.70	<0.06	0.08-0.12	6.1-8.4	High---------	0.32			
Croswell--------	0-4	0-10	1.30-1.55	6.0-20	0.06-0.09	3.6-6.5	Low----------	0.10	5	1	.5-2
	4-10	0-10	1.40-1.60	6.0-20	0.06-0.10	4.5-7.3	Low----------	0.10			
	10-29	0-10	1.40-1.60	6.0-20	0.06-0.09	4.5-7.3	Low----------	0.10			
	29-80	0-10	1.50-1.65	6.0-20	0.05-0.07	5.1-8.4	Low----------	0.10			
262A------------- Au Gres	0-10	0-8	1.30-1.55	6.0-20	0.07-0.10	3.6-7.3	Low----------	0.10	5	1	2-4
	10-27	1-10	1.50-1.70	6.0-20	0.06-0.09	4.5-7.3	Low----------	0.10			
	27-60	0-8	1.50-1.70	6.0-20	0.05-0.07	5.1-7.3	Low----------	0.10			
263A. Alfic Haplaquods											
264A------------- Allendale	0-11	0-12	1.25-1.40	6.0-20	0.09-0.12	4.5-7.3	Low----------	0.17	4	2	2-4
	11-25	0-15	1.35-1.45	6.0-20	0.06-0.10	4.5-7.3	Low----------	0.17			
	25-60	40-60	1.45-1.70	<0.06	0.08-0.12	6.1-8.4	High---------	0.32			
272:											
Haplaquods.											
Fluvaquents.											
273:											
Leafriver-------	0-9	---	0.10-0.25	0.6-6.0	0.35-0.50	5.6-7.3	-------------	----	2	2	50-90
	9-21	3-18	1.40-1.65	2.0-20	0.08-0.14	5.6-7.3	Low----------	0.17			
	21-60	0-10	1.50-1.65	6.0-20	0.03-0.08	5.6-7.3	Low----------	0.17			

Table 18.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi-bility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
273:											
Wakeley----------	0-6	0-10	1.00-1.20	6.0-20	0.15-0.20	5.6-7.8	Low-----------	0.10	4	1	10-15
	6-29	0-15	1.45-1.60	6.0-20	0.05-0.10	5.6-7.8	Low-----------	0.10			
	29-60	35-60	1.50-1.70	<0.2	0.08-0.12	7.4-8.4	High----------	0.32			
274.											
Typic Haplaquods											
280:											
Aquents.											
Histosols.											
281, 282.											
Borosaprists											

Table 19.--Soil and Water Features

("Flooding" and "water table" and terms such as "frequent," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
11B--------------- Eastport	A	None---------	---	---	>6.0	---	---	Low------	Low------	Moderate.
12B:										
Tawas------------	A/D	None---------	---	---	+1-1.0	Apparent	Oct-May	High-----	High-----	Moderate.
Au Gres----------	B	None---------	---	---	0.5-1.5	Apparent	Oct-May	Moderate	Low------	Moderate.
16B, 16C, 16D, 16E-------------- Graycalm	A	None---------	---	---	>6.0	---	---	Low------	Low------	Moderate.
17B--------------- Croswell	A	None---------	---	---	2.0-3.5	Apparent	Oct-May	Low------	Low------	Moderate.
18A--------------- Au Gres	B	None---------	---	---	0.5-1.5	Apparent	Oct-May	Moderate	Low------	Moderate.
19---------------- Leafriver	A/D	None---------	---	---	+1-1.0	Apparent	Oct-May	High-----	High-----	High.
26B--------------- Croswell	A	None---------	---	---	2.0-3.5	Perched	Oct-May	Low------	Low------	Moderate.
27A--------------- Au Gres	C	None---------	---	---	0.5-1.5	Perched	Oct-May	Moderate	Low------	Moderate.
28B, 28C, 28E----- East Lake	A	None---------	---	---	>6.0	---	---	Low------	Low------	Moderate.
29A--------------- Battlefield	A/D	None---------	---	---	0.5-1.5	Apparent	Oct-May	Moderate	High-----	High.
30---------------- Wheatley	A/D	None---------	---	---	+1-1.0	Apparent	Oct-May	Moderate	High-----	Low.
31B, 31C, 31D, 31E-------------- Klacking	A	None---------	---	---	>6.0	---	---	Low------	Low------	Moderate.
33B, 33C, 33D, 33E-------------- Mancelona	A	None---------	---	---	>6.0	---	---	Low------	Low------	Low.
35---------------- Kinross	A/D	None---------	---	---	+1-1.0	Apparent	Oct-May	Moderate	High-----	Moderate.
36B, 36C---------- Alcona	B	None---------	---	---	2.5-6.0	Perched	Nov-May	Moderate	Moderate	Low.
37A--------------- Richter	B	None---------	---	---	0.5-1.5	Apparent	Oct-May	High-----	High-----	Moderate.
38---------------- Tonkey	B/D	None---------	---	---	+1-1.0	Apparent	Oct-May	High-----	High-----	Low.

Table 19.--Soil and Water Features--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
39B, 39C---------- Glennie	C	None--------	---	---	3.5-4.5	Perched	Nov-May	Moderate	Moderate	Low.
40A--------------- Sprinkler	C	None--------	---	---	0.5-1.5	Apparent	Oct-May	High-----	High-----	Moderate.
41B, 41C, 41D----- McGinn	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Moderate.
42A--------------- Killmaster	C	None--------	---	---	1.0-3.0	Perched	Oct-May	High-----	Low------	Low.
43---------------- Wakeley	D	None--------	---	---	+1-1.0	Perched	Oct-May	Moderate	High-----	Moderate.
44B--------------- Bamfield	B	None--------	---	---	1.5-3.0	Perched	Nov-May	Moderate	Moderate	Moderate.
45B, 45C---------- Hoist	B	None--------	---	---	2.5-3.5	Perched	Nov-May	Moderate	Low------	Low.
46---------------- Ensley	B/D	None--------	---	---	+1-1.0	Apparent	Oct-May	High-----	High-----	Low.
53B, 53C---------- Negwegon	C	None--------	---	---	1.0-3.0	Perched	Nov-May	Moderate	High-----	Low.
54A--------------- Algonquin	D	None--------	---	---	0.5-1.5	Perched	Oct-May	High-----	High-----	Low.
55---------------- Springport	D	None--------	---	---	+1-1.0	Perched	Oct-Jun	High-----	High-----	Low.
56B, 56C---------- Nester	C	None--------	---	---	2.5-5.0	Perched	Nov-May	Moderate	High-----	Low.
57B--------------- Kawkawlin	C	None--------	---	---	1.0-2.0	Apparent	Oct-May	High-----	High-----	Low.
59B:										
Algonquin--------	D	None--------	---	---	0.5-1.5	Perched	Oct-May	High-----	High-----	Low.
Springport-------	D	None--------	---	---	+1-1.0	Perched	Oct-Jun	High-----	High-----	Low.
60D, 60E---------- Glennie	C	None--------	---	---	>6.0	---	---	Moderate	Moderate	Low.
61C, 61D, 61F----- Manistee	A	None--------	---	---	>6.0	---	---	Low------	High-----	Moderate.
62A--------------- Allendale	C	None--------	---	---	0.5-1.5	Perched	Oct-May	Moderate	High-----	Moderate.
63C, 63D, 63F----- Bamfield	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
66D, 66E---------- Alcona	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
68---------------- Rondeau	A/D	None--------	---	---	+1-1.0	Apparent	Oct-May	High-----	High-----	Low.

Table 19.--Soil and Water Features--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
69. Loxley	A/D	None	---	---	+1-1.0	Apparent	Oct-May	High	High	High.
70. Lupton	A/D	None	---	---	+1-1.0	Apparent	Oct-May	High	High	Low.
71. Tawas	A/D	None	---	---	+1-1.0	Apparent	Oct-May	High	High	Moderate.
72. Dorval	A/D	None	---	---	+1-1.0	Perched	Oct-May	High	High	Moderate.
73. Markey	A/D	None	---	---	+1-1.0	Apparent	Oct-May	High	High	Low.
74C2. Negwegon	C	None	---	---	1.0-3.0	Perched	Nov-May	Moderate	High	Low.
77. Waucedah	D	Frequent	Brief to very long.	Mar-May	+2-1.0	Apparent	Oct-May	High	Moderate	Low.
78. Pits										
80F:										
Zimmerman	A	None	---	---	>6.0	---	---	Low	Low	High.
Alcona	B	None	---	---	>6.0	---	---	Moderate	Low	Low.
81B, 81C, 81E. Grayling	A	None	---	---	>6.0	---	---	Low	Low	Moderate.
82C. Udorthents	---	None	---	---	>6.0	---	---	---	---	---
83F. Udipsamments	A	None	---	---	>6.0	---	---	Low	Low	Moderate.
84B, 84C, 84D. Zimmerman	A	None	---	---	>6.0	---	---	Low	Low	High.
85B, 85D:										
Zimmerman	A	None	---	---	>6.0	---	---	Low	Low	High.
Alcona	B	None	---	---	2.5-6.0	Perched	Nov-May	Moderate	Moderate	Low.
86:										
Histosols	D	None	---	---	+1-0	Apparent	Jan-Dec	High	---	---
Aquents	D	None	---	---	+1-0	Apparent	Jan-Dec	High	---	---
87. Ausable	D	Frequent	Brief or long.	Nov-May	+1.-1.0	Apparent	Oct-May	Moderate	High	Low.
88D. Hoist	B	None	---	---	>6.0	---	---	Moderate	Low	Moderate.
89F:										
Bamfield	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.

Table 19.--Soil and Water Features--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
89F:										
Lupton	D	None	---	---	+2-0	Apparent	Jan-Dec	High	High	Low.
90B Chinwhisker	A	None	---	---	2.0-4.0	Apparent	Nov-May	Low	Low	Moderate.
91E:										
Glennie	C	None	---	---	>6.0	---	---	Moderate	Moderate	Low.
Lupton	D	None	---	---	+2-0	Apparent	Jan-Dec	High	High	Low.
92B:										
Klacking	A	None	---	---	>6.0	---	---	Low	Low	Moderate.
McGinn	B	None	---	---	>6.0	---	---	Moderate	Low	Moderate.
93B:										
Au Gres	C	None	---	---	1.0-3.0	Perched	Oct-May	Moderate	Low	Moderate.
Wakeley	D	None	---	---	+1-1.0	Perched	Oct-May	Moderate	High	Moderate.
94F:										
Klacking	A	None	---	---	>6.0	---	---	Low	Low	Moderate.
McGinn	B	None	---	---	>6.0	---	---	Moderate	Low	Moderate.
96D2 Negwegon	C	None	---	---	>6.0	---	---	Moderate	High	Low.
97 Colonville	C	Occasional	Brief	Dec-May	1.0-2.0	Apparent	Oct-May	High	Low	Low.
98C Graycalm	A	None	---	---	>6.0	---	---	Low	Low	Moderate.
102D, 102E, 102F Nester	C	None	---	---	>6.0	---	---	Moderate	High	Low.
110D, 110F Negwegon	C	None	---	---	>6.0	---	---	Moderate	High	Low.
111B Manistee	A	None	---	---	2.5-4.0	Perched	Nov-May	Low	High	Moderate.
209B Grayling	A	None	---	---	>15	---	---	Low	Low	High.
210B, 210C, 210D Grayling	A	None	---	---	>15	---	---	Low	Low	Moderate.
211B, 211C Grayling	A	None	---	---	>15	---	---	Low	Low	High.
212B Grayling	A	None	---	---	6.0-15	---	---	Low	Low	Moderate.
213B, 213C Graycalm	A	None	---	---	>15	---	---	Low	Low	Moderate.

Table 19.--Soil and Water Features--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
215C, 220B, 220C, 220D, 220E, 221B, 221C, 221D: Typic Udipsamments	A	None	---	---	>15	---	---	Low	Low	High.
222B: Typic Udipsamments	A	None	---	---	5.0-10	Apparent	Jan-Dec	Low	Low	High.
223B, 223C, 223D: Graycalm	A	None	---	---	>15	---	---	Low	Low	Moderate.
Grayling	A	None	---	---	>15	---	---	Low	Low	Moderate.
224B: Croswell	A	None	---	---	2.0-3.5	Apparent	Oct-May	Low	Low	Moderate.
225B, 225C: Entic Haplorthods	A	None	---	---	>15	---	---	Low	Low	High.
230C, 231B, 231C, 231D: Entic Haplorthods	A	None	---	---	>15	---	---	Low	Low	High.
Alfic Haplorthods	A	None	---	---	>15	---	---	Low	Low	High.
232B: Entic Haplorthods	A	None	---	---	6.0-15	Apparent	Jan-Dec	Low	Low	High.
Alfic Haplorthods	A	None	---	---	6.0-15	Apparent	Jan-Dec	Low	Low	High.
233B, 233C, 233D: Alfic Haplorthods	A	None	---	---	>15	---	---	Low	Low	High.
Entic Haplorthods	A	None	---	---	>15	---	---	Low	Low	High.
235B, 235C, 235D: Alfic Haplorthods, sandy over loamy	A	None	---	---	>15	---	---	Low	Low	Moderate.
Alfic Haplorthods, sandy	A	None	---	---	>15	---	---	Low	Low	High.
236B, 236C: Arenic Eutroboralfs	---	None	---	---	---	---	---	---	---	---
237B, 237C, 237D: Glossic Eutroboralfs	---	None	---	---	---	---	---	---	---	---

Table 19.--Soil and Water Features--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
247B:										
Glennie----------	C	None--------	---	---	3.5-4.5	Perched	Nov-May	Moderate	Moderate	Low.
Bamfield---------	B	None--------	---	---	1.5-3.0	Perched	Nov-May	Moderate	Moderate	Moderate.
247C:										
Glennie----------	C	None--------	---	---	3.5-4.5	Perched	Nov-Apr	Moderate	Moderate	Low.
Bamfield---------	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
247D:										
Glennie----------	C	None--------	---	---	>6.0	---	---	Moderate	Moderate	Low.
Bamfield---------	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
250D:										
Glossic Eutroboralfs----	---	None--------	---	---	>6.0	---	---	---	---	---
Borosaprists-----	D	None--------	---	---	+1-1.0	Apparent	Oct-May	High-----	High-----	Moderate.
252A:										
Borosaprists-----	D	None--------	---	---	+1-1.0	Apparent	Oct-May	High-----	High-----	Moderate.
Au Gres----------	B	None--------	---	---	0.5-1.5	Apparent	Oct-May	Moderate	Low------	Moderate.
253A:										
Au Gres----------	B	None--------	---	---	0.5-1.5	Apparent	Oct-May	Moderate	Low------	Moderate.
Allendale--------	C	None--------	---	---	0.5-1.5	Perched	Oct-May	Moderate	High-----	Moderate.
Croswell---------	A	None--------	---	---	2.0-3.5	Apparent	Oct-May	Low------	Low------	Moderate.
262A-------------- Au Gres	B	None--------	---	---	0.5-1.5	Apparent	Oct-May	Moderate	Low------	Moderate.
263A-------------- Alfic Haplaquods	A	None--------	---	---	0.5-1.5	Apparent	Oct-May	Moderate	---	---
264A-------------- Allendale	C	None--------	---	---	0.5-1.5	Perched	Oct-May	Moderate	High-----	Moderate.
272:										
Haplaquods-------	---	None--------	---	---	+1-1.0	Apparent	Oct-May	---	---	---
Fluvaquents------	---	Frequent----	Brief-----	Nov-Apr	+1-1.0	Apparent	Oct-May	---	---	---
273:										
Leafriver--------	A/D	None--------	---	---	+1-1.0	Apparent	Oct-May	High-----	High-----	High.
Wakeley----------	D	None--------	---	---	+1-1.0	Perched	Oct-May	Moderate	High-----	Moderate.
274--------------- Typic Haplaquods	D	None--------	---	---	+1-1.0	Apparent	Oct-May	High-----	---	---
280:										
Aquents----------	D	None--------	---	---	+1-0	Apparent	Jan-Dec	High-----	---	---
Histosols--------	D	None--------	---	---	+1-0	Apparent	Jan-Dec	High-----	---	---

Table 19.--Soil and Water Features--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
281--------------- Borosaprists	D	None---------	---	---	+1-1.0	Apparent	Oct-May	High-----	High-----	High.
282--------------- Borosaprists	D	None---------	---	---	+1-1.0	Apparent	Oct-May	High-----	High-----	Moderate.

Table 20.--Classification of the Soils

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Alcona	Coarse-loamy, mixed, frigid Alfic Haplorthods
Alfic Haplaquods	Alfic Haplaquods
Alfic Haplorthods, sandy	Sandy, mixed, frigid Alfic Haplorthods
Alfic Haplorthods, sandy over loamy	Sandy over loamy, mixed, frigid Alfic Haplorthods
Algonquin	Fine, mixed Aquic Eutroboralfs
Allendale	Sandy over clayey, mixed, frigid Alfic Haplaquods
Aquents	Aquents
Arenic Eutroboralfs	Mixed, frigid Arenic Eutroboralfs
Au Gres	Sandy, mixed, frigid Typic Haplaquods
Ausable	Sandy, mixed, frigid Histic Humaquepts
Bamfield	Fine-loamy, mixed Typic Glossoboralfs
Battlefield	Sandy, mixed, frigid Entic Haplaquods
Borosaprists	Euic Borosaprists
Borosaprists	Dysic Borosaprists
Chinwhisker	Sandy, mixed, frigid Entic Haplorthods
*Colonville	Coarse-loamy, mixed (calcareous), frigid Fluvaquentic Haplaquolls
Croswell	Sandy, mixed, frigid Entic Haplorthods
Dorval	Clayey, mixed, euic Terric Borosaprists
East Lake	Sandy, mixed, frigid Entic Haplorthods
Eastport	Mixed, frigid Spodic Udipsamments
Ensley	Coarse-loamy, mixed, nonacid, frigid Aeric Haplaquepts
Entic Haplorthods	Sandy, mixed, frigid Entic Haplorthods
Fluvaquents	Fluvaquents
Glennie	Coarse-loamy, mixed Typic Fragiboralfs
Glossic Eutroboralfs	Glossic Eutroboralfs
Graycalm	Mixed, frigid Alfic Udipsamments
Grayling	Mixed, frigid Typic Udipsamments
Haplaquods	Haplaquods
Histosols	Histosols
Hoist	Coarse-loamy, mixed Glossic Eutroboralfs
Kawkawlin	Fine, mixed Glossaquic Eutroboralfs
Killmaster	Coarse-loamy, mixed Glossaquic Eutroboralfs
Kinross	Sandy, mixed, frigid Typic Haplaquods
Klacking	Coarse-loamy, mixed Psammentic Eutroboralfs
Leafriver	Sandy, mixed, frigid Histic Humaquepts
Loxley	Dysic Typic Borosaprists
Lupton	Euic Typic Borosaprists
Mancelona	Sandy, mixed, frigid Alfic Haplorthods
Manistee	Sandy over clayey, mixed, frigid Alfic Haplorthods
Markey	Sandy or sandy-skeletal, mixed, euic Terric Borosaprists
McGinn	Coarse-loamy, mixed Typic Glossoboralfs
Negwegon	Fine, mixed Glossic Eutroboralfs
Nester	Fine, mixed Glossic Eutroboralfs
Richter	Coarse-loamy, mixed, frigid Alfic Haplaquods
Rondeau	Marly, euic Limnic Borosaprists
Springport	Fine, mixed, nonacid, frigid Typic Haplaquolls
Sprinkler	Fine-loamy, mixed Aquic Glossoboralfs
Tawas	Sandy or sandy-skeletal, mixed, euic Terric Borosaprists
*Tonkey	Coarse-loamy, mixed, nonacid, frigid Mollic Haplaquepts
Typic Haplaquods	Mixed, frigid Typic Haplaquods
Typic Udipsamments	Mixed, frigid Typic Udipsamments
Udipsamments	Udipsamments
Udorthents	Udorthents
Wakeley	Sandy over clayey, mixed, nonacid, frigid Aeric Haplaquents
Waucedah	Coarse-loamy, mixed, nonacid, frigid Histic Humaquepts
*Wheatley	Mixed, frigid Mollic Psammaquents
Zimmerman	Mixed, frigid Alfic Udipsamments

Interpretive Groups

Interpretive Groups

(Dashes indicate that the interpretive group is not assigned)

Soil name and map symbol	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group	Primary and secondary plant associations*
11B---------------------- Eastport	VIs	No	5S	5.3a	---
12B-----------------------	VIw	No			---
Tawas--------------------			5W	M/4c	
Au Gres------------------			6W	5b	
16B---------------------- Graycalm	IVs	No	6S	5a	---
16C, 16D----------------- Graycalm	VIs	No	6S	5a	---
16E---------------------- Graycalm	VIIs	No	6R	5a	---
17B---------------------- Croswell	IVs	No	5S	5a	---
18A---------------------- Au Gres	IVw	No	6W	5b	---
19----------------------- Leafriver	VIw	No	2W	5c	---
26B---------------------- Croswell	IVs	No	7S	5a	---
27A---------------------- Au Gres	IVw	No	7W	5b	---
28B---------------------- East Lake	IVs	No	2S	5a	---
28C---------------------- East Lake	VIs	No	2S	5a	---
28E---------------------- East Lake	VIIs	No	2R	5a	---
29A---------------------- Battlefield	IVw	No	5W	5b	---
30----------------------- Wheatley	Vw	No	2W	5c	---
31B---------------------- Klacking	IIIs	No	6S	4a	---
31C---------------------- Klacking	IIIe	No	6S	4a	---
31D---------------------- Klacking	IVe	No	6S	4a	---
31E---------------------- Klacking	VIIe	No	6R	4a	---

See footnote at end of table.

Interpretive Groups--Continued

Soil name and map symbol	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group	Primary and secondary plant associations*
33B----------------------- Mancelona	IIIs	No	3A	4a	---
33C----------------------- Mancelona	IIIe	No	3A	4a	---
33D----------------------- Mancelona	IVe	No	3A	4a	---
33E----------------------- Mancelona	VIIe	No	3R	4a	---
35------------------------ Kinross	VIw	No	2W	5c-a	---
36B----------------------- Alcona	IIe	Yes	3L	3a-s	---
36C----------------------- Alcona	IIIe	No	3L	3a-s	---
37A----------------------- Richter	IIw	Yes	3W	3b-s	---
38------------------------ Tonkey	Vw	Yes	5W	3c-s	---
39B----------------------- Glennie	IIIs	No	5D	4/2a-f	---
39C----------------------- Glennie	IIIe	No	5D	4/2a-f	---
40A----------------------- Sprinkler	IIw	Yes	3W	2.5b	---
41B----------------------- McGinn	IIIs	Yes	4S	4a	---
41C----------------------- McGinn	IIIe	No	4S	4a	---
41D----------------------- McGinn	IVe	No	4S	4a	---
42A----------------------- Killmaster	IIw	Yes	4W	3b	---
43------------------------ Wakeley	Vw	No	3W	4/1c	---
44B----------------------- Bamfield	IIe	Yes	3L	3/2a	---
45B----------------------- Hoist	IIe	Yes	3L	3a	---
45C----------------------- Hoist	IIIe	No	3L	3a	---
46------------------------ Ensley	Vw	Yes	3W	3c	---

See footnote at end of table.

Interpretive Groups--Continued

Soil name and map symbol	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group	Primary and secondary plant associations*
53B: Negwegon	IIIe	Yes	3L	1a	---
53C: Negwegon	IIIe	No	3L	1a	---
54A: Algonquin	IIIw	Yes	6W	1b	---
55: Springport	IIIw	Yes	6W	1c	---
56B: Nester	IIe	Yes	3L	1.5a	---
56C: Nester	IIIe	No	3L	1.5a	---
57B: Kawkawlin	IIe	Yes	3W	1.5b	---
59B:	IIIe	Yes			---
Algonquin			6W	1b	
Springport			6W	1c	
60D: Glennie	IVe	No	5D	4/2a-f	---
60E: Glennie	VIIe	No	5R	4/2a-f	---
61C: Manistee	IIIe	No	3A	4/1a	---
61D: Manistee	IVe	No	3A	4/1a	---
61F: Manistee	VIIe	No	3R	4/1a	---
62A: Allendale	IIIw	No	4W	4/1b	---
63C: Bamfield	IIIe	No	3L	1.5a	---
63D: Bamfield	IVe	No	3L	1.5a	---
63F: Bamfield	VIIe	No	3R	1.5a	---
66D: Alcona	IVe	No	3L	3a-s	---
66E: Alcona	VIIe	No	3R	3a-s	---
68: Rondeau	VIw	No	---	M/mc	---

See footnote at end of table.

Interpretive Groups--Continued

Soil name and map symbol	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group	Primary and secondary plant associations*
69----------------------- Loxley	VIIw	No	2W	Mc-a	---
70----------------------- Lupton	VIw	No	2W	Mc	---
71----------------------- Tawas	VIw	No	5W	M/4c	---
72----------------------- Dorval	Vw	No	2W	M/1c	---
73----------------------- Markey	Vw	No	---	M/4c	---
74C2--------------------- Negwegon	IIIe	No	---	1a	---
77----------------------- Waucedah	Vw	No	3W	L-2c	---
78. Pits					
80F----------------------	VIIe	No			---
Zimmerman---------------			8R	4a	
Alcona------------------			3R	3a-s	
81B, 81C----------------- Grayling	VIs	No	4S	5.7a	---
81E---------------------- Grayling	VIIs	No	4R	5.7a	---
82C. Udorthents					
83F. Udipsamments					
84B---------------------- Zimmerman	IVs	No	8S	4a	---
84C, 84D----------------- Zimmerman	VIs	No	8S	4a	---
85B----------------------	IVs	No			---
Zimmerman---------------			8S	4a	
Alcona------------------			3L	3a-s	
85D----------------------	VIs	No			---
Zimmerman---------------			8S	4a	
Alcona------------------			3L	3a-s	
86. Histosols and Aquents					
87----------------------- Ausable	VIIw	No	2W	L-4c	---

See footnote at end of table.

Interpretive Groups--Continued

Soil name and map symbol	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group	Primary and secondary plant associations*
88D: Hoist	IVe	No	3L	3a	---
89F:	VIIe	No			---
Bamfield			3R	1.5a	
Lupton			---	Mc	
90B: Chinwhisker	IVs	No	6S	5a	---
91E:	VIe	No			---
Glennie			5R	4/2a-f	
Lupton			---	Mc	
92B:	IIIs	No			---
Klacking			6S	4a	
McGinn			4S	4a	
93B:	IVw	No			---
Au Gres			7W	5b	
Wakeley			3W	4/1c	
94F:	VIIe	No			---
Klacking			6R	4a	
McGinn			4R	4a	
96D2: Negwegon	IVe	No	---	1a	---
97: Colonville	Vw	Yes	3W	L-2c	---
98C: Graycalm	VIs	No	6S	5a	---
102D: Nester	IVe	No	3L	1.5a	---
102E: Nester	VIe	No	3R	1.5a	---
102F: Nester	VIIe	No	3R	1.5a	---
110D: Negwegon	IVe	No	3L	1a	---
110F: Negwegon	VIIe	No	3R	1a	---
111B: Manistee	IIIs	No	3A	4/1a	---
209B, 210B: Grayling	VIs	No	4S	5.7a	1, 2

See footnote at end of table.

Interpretive Groups--Continued

Soil name and map symbol	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group	Primary and secondary plant associations*
210C--------------------- Grayling	VIIs	No	4S	5.7a	1, 2
210D--------------------- Grayling	VIIs	No	4R	5.7a	1, 2
211B--------------------- Grayling	VIs	No	4S	5.7a	1, 2
211C--------------------- Grayling	VIIs	No	4S	5.7a	1, 2
212B--------------------- Grayling	VIs	No	4S	5.7a	1, 2
213B--------------------- Graycalm	IVs	No	6S	5a	1, 2
213C--------------------- Graycalm	VIs	No	6S	5a	1, 2
215C--------------------- Typic Udipsamments	VIIs	No	---	---	1, 2
220B--------------------- Typic Udipsamments	VIs	No	---	---	2, 1
220C, 220D, 220E--------- Typic Udipsamments	VIIs	No	---	---	2, 1
221B--------------------- Typic Udipsamments	VIs	No	---	---	2, 1
221C, 221D--------------- Typic Udipsamments	VIIs	No	---	---	2, 1
222B--------------------- Typic Udipsamments	VIs	No	---	---	2, 1
223B---------------------	IVs	No			2, 1
Graycalm----------------			6S	5a	
Grayling----------------			4S	5.7a	
223C---------------------	VIs	No			2, 1
Graycalm----------------			6S	5a	
Grayling----------------			4S	5.7a	
223D---------------------	VIIs	No			2, 1
Graycalm----------------			6R	5a	
Grayling----------------			4R	5.7a	
224B--------------------- Croswell	IVs	No	5S	5a	2, 1
225B--------------------- Entic Haplorthods	VIs	No	---	---	2, 3
225C--------------------- Entic Haplorthods	VIIs	No	---	---	2, 3

See footnote at end of table.

Interpretive Groups--Continued

Soil name and map symbol	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group	Primary and secondary plant associations*
230C--------------------- Entic Haplorthods- Alfic Haplorthods	VIIs	No	---	---	3, 2
231B--------------------- Entic Haplorthods- Alfic Haplorthods	VIs	No	---	---	3, 2
231C, 231D--------------- Entic Haplorthods- Alfic Haplorthods	VIIs	No	---	---	3, 2
232B--------------------- Entic Haplorthods- Alfic Haplorthods	VIs	No	---	---	3, 2
233B--------------------- Alfic Haplorthods- Entic Haplorthods	IIIs	No	---	---	3, 2
233C--------------------- Alfic Haplorthods- Entic Haplorthods	IVe	No	---	---	3, 2
233D--------------------- Alfic Haplorthods- Entic Haplorthods	VIIe	No	---	---	3, 2
235B--------------------- Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy	IIIs	No	---	---	3, 4
235C--------------------- Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy	IVe	No	---	---	3, 4
235D--------------------- Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy	VIIe	No	---	---	3, 4
236B, 236C--------------- Arenic Eutroboralfs	---	No	---	---	3, 4
237B, 237C, 237D--------- Glossic Eutroboralfs	---	No	---	---	4, 3
247B---------------------	IIIs	No			6, 4
Glennie-----------------			5D	4/2a-f	
Bamfield----------------			3L	3/2a	
247C---------------------	IVe	No			6, 4
Glennie-----------------			5D	4/2a-f	
Bamfield----------------			3L	3/2a	

See footnote at end of table.

Interpretive Groups--Continued

Soil name and map symbol	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group	Primary and secondary plant associations*
247D	VIe	No			6, 4
Glennie			5R	4/2a-f	
Bamfield			3R	3/2a	
250D. Glossic Eutroboralfs-Borosaprists					
252A	---	No			7, 8
Borosaprists			---	---	
Au Gres			6W	5b	
253A	IVw	No			---
Au Gres			6W	5b	
Allendale			4W	4/1b	
Croswell			5S	5a	
262A Au Gres	IVw	No	6W	5b	7, 8
263A Alfic Haplaquods	---	No	---	---	8, 7
264A Allendale	IIIw	No	4W	4/1b	9, 8
272 Haplaquods-Fluvaquents	---	No	---	---	7, 8
273	VIw	No			8, 7
Leafriver			2W	5c	
Wakeley			3W	4/1c	
274 Typic Haplaquods	---	No	---	---	9, 11
280. Aquents and Histosols					
281 Borosaprists	---	No	---	---	10
282 Borosaprists	---	No	---	---	11, 9

* See text for descriptions of these plant associations.

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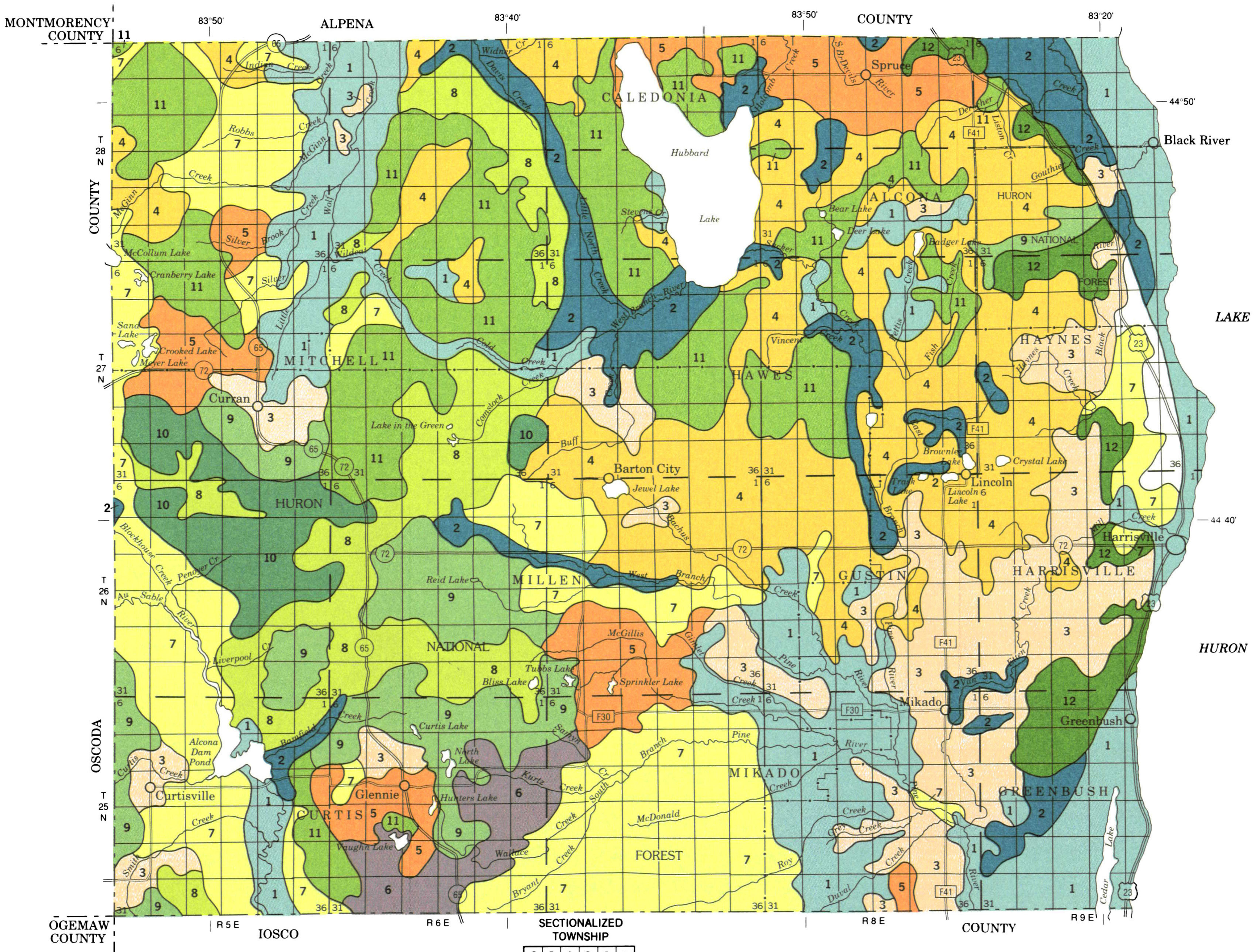


SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL LEGEND*

NEARLY LEVEL AND GENTLY UNDULATING SOILS THAT ARE VERY POORLY DRAINED AND SOMEWHAT POORLY DRAINED

1 Au Gres-Wakeley-Tawas association

2 Lupton-Tawas-Leafriver association

NEARLY LEVEL TO ROLLING SOILS THAT ARE WELL DRAINED TO POORLY DRAIN

3 Algonquin-Negwegon-Springport association

4 McGinn-Hoist-Klacking association

5 Bamfield-Nester-Glossic Eutroboralfs association

6 Glennie-Sprinkler association

NEARLY LEVEL TO HILLY SOILS THAT ARE EXCESSIVELY DRAINED TO WELL DRAINED

7 Grayling-Graycalm-Typic Udipsamments association

8 Klacking-Graycalm-Grayling association

NEARLY LEVEL TO VERY STEEP SOILS THAT ARE VERY POORLY DRAINED, MODERATELY WELL DRAINED, AND EXCESSIVELY DRAINED

9 Glennie-Bamfield-Lupton association

10 Alfic Haplorthods association

11 Klacking-McGinn association

12 Zimmerman-Alcona association

*The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1996

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
FOREST SERVICE
MICHIGAN DEPARTMENT OF AGRICULTURE
MICHIGAN AGRICULTURAL EXPERIMENT STATION
MICHIGAN STATE UNIVERSITY EXTENSION
MICHIGAN TECHNOLOGICAL UNIVERSITY

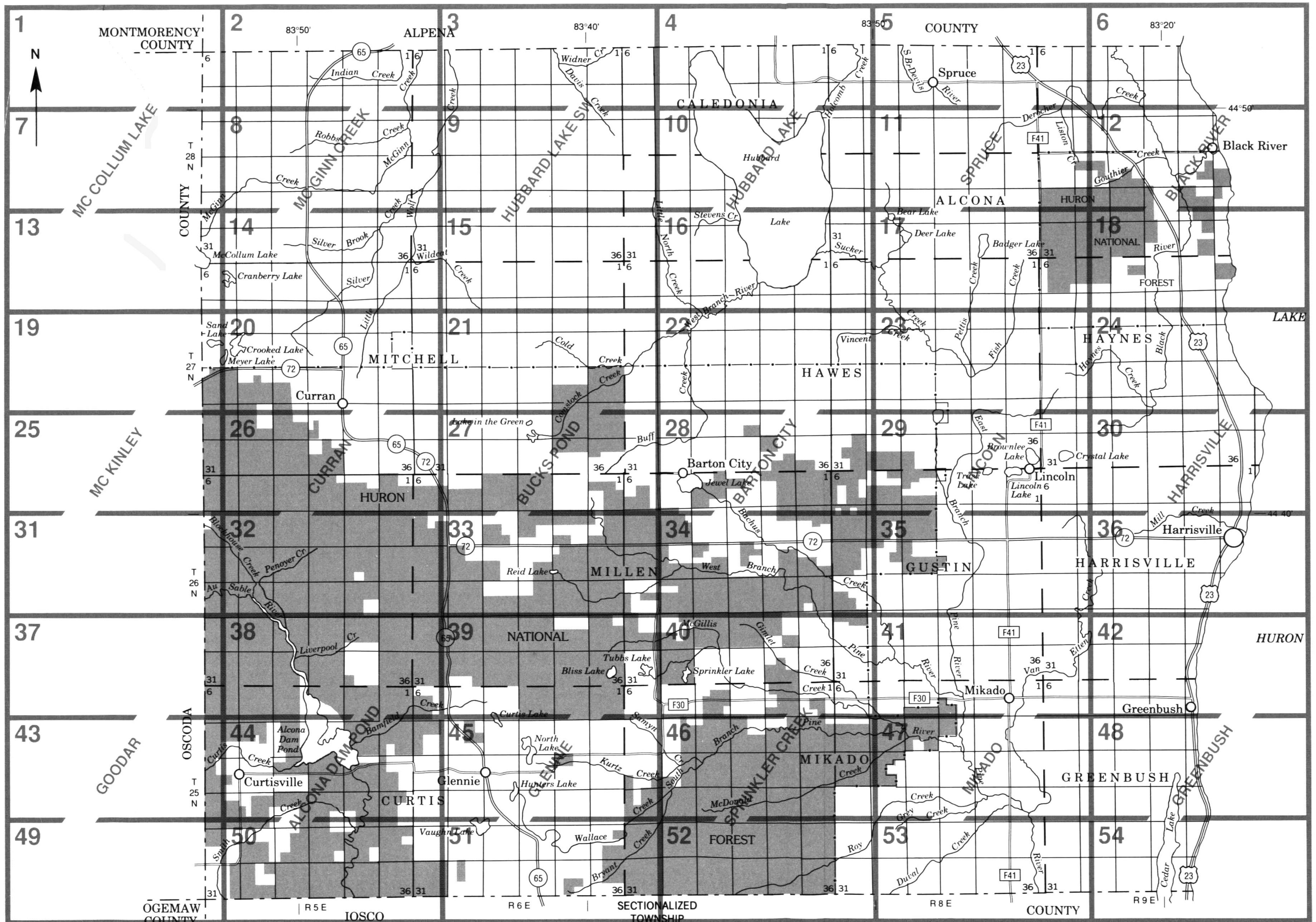
GENERAL SOIL MAP
ALCONA COUNTY, MICHIGAN

Scale 1:190,080

1 0 1 2 3 Mi

1 0 3 6 Km

Original text from each map sheet:
"This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned."



6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

AREAS MAPPED BY THE U.S. FOREST SERVICE

INDEX TO MAP SHEETS
ALCONA COUNTY, MICHIGAN

Scale 1:190,080

1 0 1 2 3 Mi

1 0 3 6 Km

SOIL LEGEND

Map symbols consist of numbers, or a combination of numbers and letters. The initial numbers represent the kind of soil. A capital letter following those numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
11B	Eastport sand, 0 to 6 percent slopes
12B	Tawas-Au Gres complex, 0 to 4 percent slopes
16B	Graycalm sand, 0 to 6 percent slopes
16C	Graycalm sand, 6 to 12 percent slopes
16D	Graycalm sand, 12 to 18 percent slopes
16E	Graycalm sand, 18 to 35 percent slopes
17B	Croswell sand, 0 to 6 percent slopes
18A	Au Gres sand, 0 to 3 percent slopes
19	Leafriver muck
26B	Croswell sand, loamy substratum, 0 to 6 percent slopes
27A	Au Gres sand, clayey substratum, 0 to 3 percent slopes
28B	East Lake sand, 0 to 6 percent slopes
28C	East Lake sand, 6 to 12 percent slopes
28E	East Lake sand, 12 to 35 percent slopes
29A	Battlefield sand, 0 to 3 percent slopes
30	Wheatley muck
31B	Klacking loamy sand, 0 to 6 percent slopes
31C	Klacking loamy sand, 6 to 12 percent slopes
31D	Klacking loamy sand, 12 to 18 percent slopes
31E	Klacking loamy sand, 18 to 35 percent slopes
33B	Mancelona loamy sand, 0 to 6 percent slopes
33C	Mancelona loamy sand, 6 to 12 percent slopes
33D	Mancelona loamy sand, 12 to 18 percent slopes
33E	Mancelona loamy sand, 18 to 35 percent slopes
35	Kinross muck
36B	Alcona loamy very fine sand, moderately wet, 0 to 6 percent slopes
36C	Alcona loamy very fine sand, moderately wet, 6 to 12 percent slopes
37A	Richter loamy fine sand, 0 to 3 percent slopes
38	Tonkey silt loam
39B	Glennie loamy sand, moderately wet, 0 to 6 percent slopes
39C	Glennie loamy sand, moderately wet, 6 to 12 percent slopes
40A	Sprinkler sandy loam, 0 to 3 percent slopes
41B	McGinn loamy sand, 0 to 6 percent slopes
41C	McGinn loamy sand, 6 to 12 percent slopes
41D	McGinn loamy sand, 12 to 18 percent slopes
42A	Killmaster sandy loam, 0 to 3 percent slopes
43	Wakeley mucky sand
44B	Bamfield fine sandy loam, moderately wet, 0 to 6 percent slopes
45B	Hoist sandy loam, moderately wet, 0 to 6 percent slopes
45C	Hoist sandy loam, moderately wet, 6 to 12 percent slopes
46	Ensley mucky sandy loam
53B	Negwegon silt loam, moderately wet, 2 to 6 percent slopes
53C	Negwegon silt loam, moderately wet, 6 to 12 percent slopes
54A	Algonquin silt loam, 0 to 3 percent slopes
55	Springport clay loam
56B	Nester loam, moderately wet, 0 to 6 percent slopes
56C	Nester loam, moderately wet, 6 to 12 percent slopes
57B	Kawkawlin loam, 1 to 4 percent slopes
59B	Algonquin-Springport complex, 0 to 6 percent slopes
60D	Glennie loamy sand, 12 to 18 percent slopes
60E	Glennie loamy sand, 18 to 35 percent slopes
61C	Manistee loamy sand, 6 to 12 percent slopes
61D	Manistee loamy sand, 12 to 18 percent slopes
61F	Manistee loamy sand, 25 to 45 percent slopes
62A	Allendale loamy sand, 0 to 3 percent slopes
63C	Bamfield fine sandy loam, 6 to 12 percent slopes
63D	Bamfield fine sandy loam, 12 to 18 percent slopes
63F	Bamfield fine sandy loam, 25 to 45 percent slopes
66D	Alcona loamy very fine sand, 12 to 18 percent slopes
66E	Alcona loamy very fine sand, 18 to 35 percent slopes
68	Rondeau muck
69	Loxley peat
70	Lupton muck
71	Tawas muck
72	Dorval muck
73	Markey muck
74C2	Negwegon silty clay loam, moderately wet, 6 to 12 percent slopes, eroded
77	Waucedah muck, frequently flooded
78	Pits, borrow
80F	Zimmerman-Alcona complex, 25 to 60 percent slopes
81B	Grayling sand, 0 to 6 percent slopes
81C	Grayling sand, 6 to 12 percent slopes
81E	Grayling sand, 18 to 35 percent slopes
82C	Udorthents, loamy, nearly level to gently rolling
83F	Udipsamments, nearly level to very steep
84B	Zimmerman loamy fine sand, 0 to 6 percent slopes
84C	Zimmerman loamy fine sand, 6 to 12 percent slopes
84D	Zimmerman loamy fine sand, 12 to 18 percent slopes
85B	Zimmerman-Alcona, moderately wet complex, 0 to 6 percent slopes
85D	Zimmerman-Alcona, moderately wet complex, 6 to 18 percent slopes
86	Histosols and Aquents, ponded
87	Ausable muck, frequently flooded
88D	Hoist sandy loam, 12 to 18 percent slopes
89F	Bamfield-Lupton complex, 0 to 45 percent slopes
90B	Chinwhisker sand, 0 to 4 percent slopes
91E	Glennie-Lupton complex, 0 to 35 percent slopes
92B	Klacking-McGinn loamy sands, 0 to 6 percent slopes
93B	Au Gres, clayey substratum-Wakeley complex, 0 to 4 percent slopes
94F	Klacking-McGinn loamy sand, 8 to 50 percent slopes, dissected
96D2	Negwegon silty clay loam, 12 to 18 percent slopes, eroded
97	Colonville very fine sandy loam, occasionally flooded
98C	Graycalm sand, pitted outwash, 0 to 12 percent slopes
102D	Nester loam, 12 to 18 percent slopes
102E	Nester loam, 18 to 25 percent slopes
102F	Nester loam, 25 to 45 percent slopes
110D	Negwegon silt loam, 12 to 18 percent slopes
110F	Negwegon silt loam, 25 to 45 percent slopes
111B	Manistee loamy sand, moderately wet, 0 to 6 percent slopes
209B	Grayling sand, calcareous substratum, nearly level and undulating
210B	Grayling sand, nearly level and undulating
210C	Grayling sand, rolling
210D	Grayling sand, hilly
211B	Grayling sand, banded substratum, nearly level and undulating
211C	Grayling sand, banded substratum, rolling
212B	Grayling sand, very deep water table, nearly level and undulating
213B	Graycalm sand, nearly level and undulating
213C	Graycalm sand, rolling
215C	Typic Udipsamments, loamy substratum, rolling
220B	Typic Udipsamments, nearly level and undulating
220C	Typic Udipsamments, rolling
220D	Typic Udipsamments, hilly
220E	Typic Udipsamments, steep
221B	Typic Udipsamments, banded substratum, nearly level and undulating
221C	Typic Udipsamments, banded substratum, rolling
221D	Typic Udipsamments, banded substratum, hilly
222B	Typic Udipsamments, very deep water table, nearly level and undulating
223B	Graycalm-Grayling sands, nearly level and undulating
223C	Graycalm-Grayling sands, rolling
223D	Graycalm-Grayling sands, hilly
224B	Croswell sand, nearly level and undulating
225B	Entic Haplorthods, sandy, loamy substratum, nearly level and undulating
225C	Entic Haplorthods, sandy, loamy substratum, rolling
230C	Entic Haplorthods, sandy-Alfic Haplorthods, sandy complex, rolling
231B	Entic Haplorthods, sandy, banded substratum-Alfic Haplorthods, sandy complex, nearly level and undulating
231C	Entic Haplorthods, sandy, banded substratum-Alfic Haplorthods, sandy complex, rolling
231D	Entic Haplorthods, sandy, banded substratum-Alfic Haplorthods, sandy complex, hilly
232B	Entic Haplorthods, sandy-Alfic Haplorthods, sandy complex, very deep water table, nearly level and undulating
233B	Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine loamy banded substratum complex, nearly level and undulating
233C	Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine loamy banded substratum complex, rolling
223D	Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine loamy banded substratum complex, hilly
235B	Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy complex, nearly level and undulating
235C	Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy complex, rolling
235D	Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy complex, hilly
236B	Arenic Eutroboralfs, nearly level and undulating
236C	Arenic Eutroboralfs, rolling
237B	Glossic Eutroboralfs, nearly level and undulating
237C	Glossic Eutroboralfs, rolling
237D	Glossic Eutroboralfs, hilly
247B	Glennie-Bamfield complex, nearly level and undulating
247C	Glennie-Bamfield complex, rolling
247D	Glennie-Bamfield complex, hilly
250D	Glossic Eutroboralfs-Borosaprists, euic complex, nearly level to hilly
252A	Borosaprists, euic-Au Gres complex, nearly level
253A	Au Gres-Allendale-Croswell sands, nearly level
262A	Au Gres sand, nearly level
263A	Alfic Haplaquods, nearly level
264A	Allendale loamy sand, nearly level
272	Haplaquods-Fluvaquents complex
273	Leafriver-Wakeley complex
274	Typic Haplaquods
280	Aquents and Histosols, ponded
281	Borosaprists, dysic
282	Borosaprists, euic

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state, or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label) — Davis Airstrip

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK
1 890 000 FEET

LAND DIVISION CORNER
(sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 66
- Federal — 287
- State — 52
- County, farm or ranch — 398

RAILROAD

POWER TRANSMISSION LINE
(normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small (Named where applicable) — water

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban area) (occupied)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 11B 12B

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

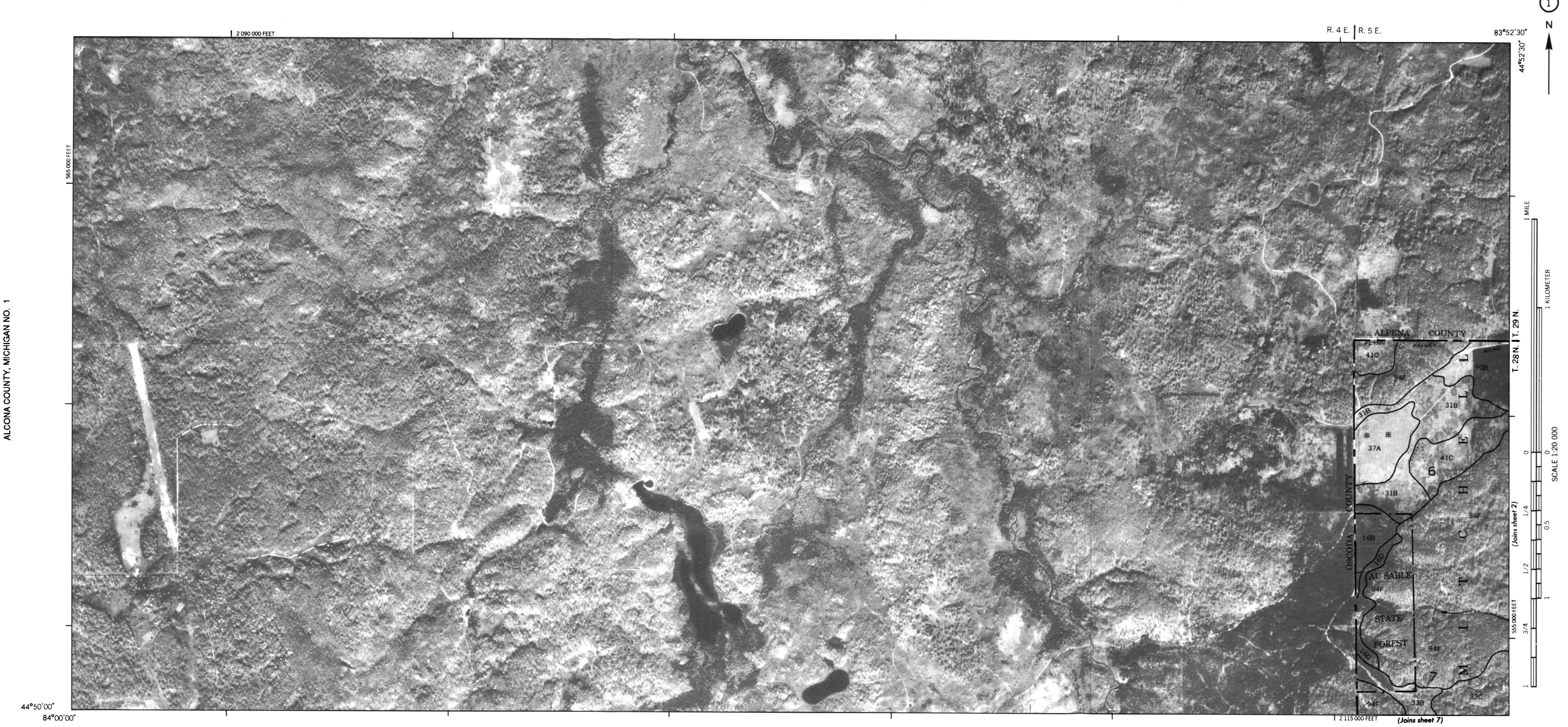
GULLY

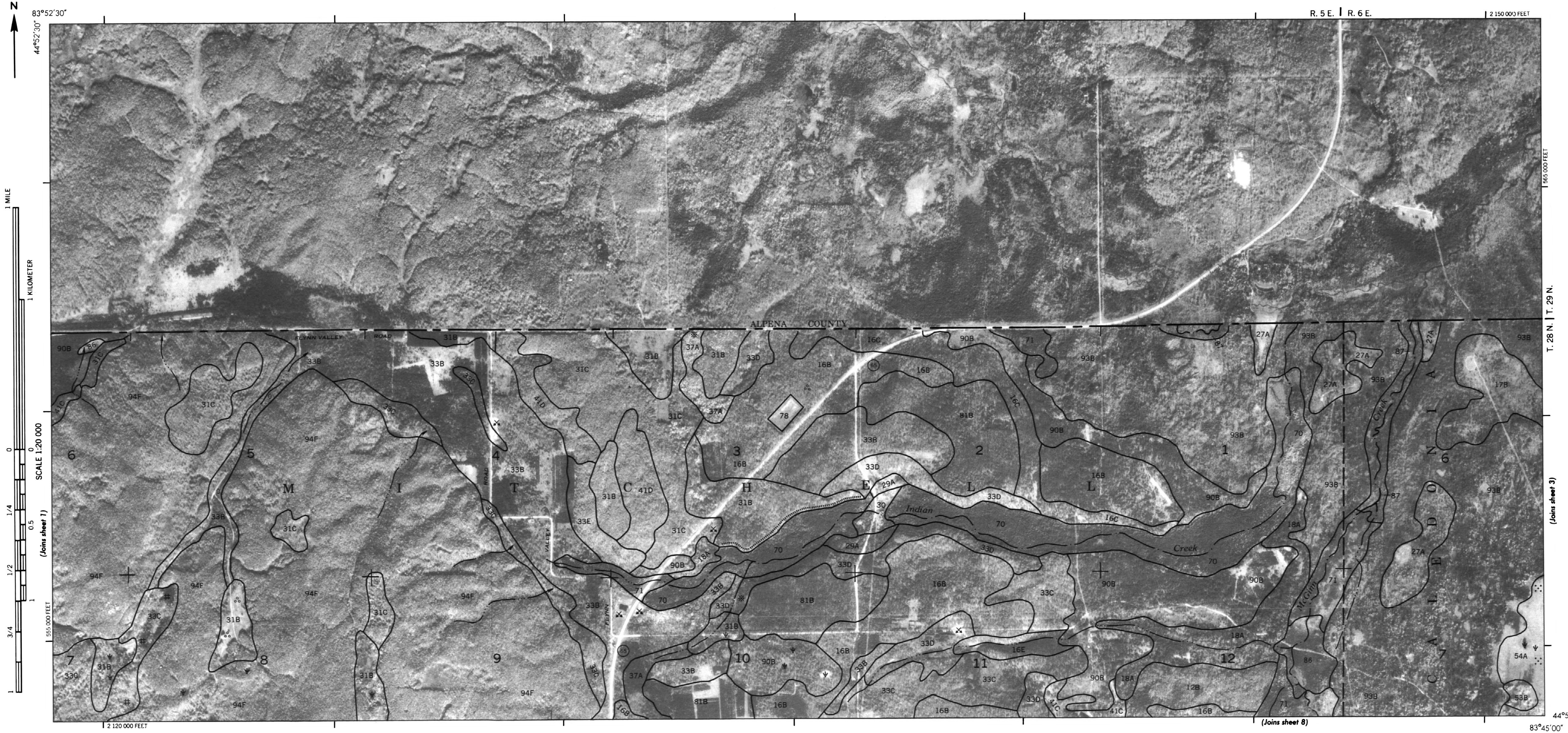
DEPRESSION (dry)

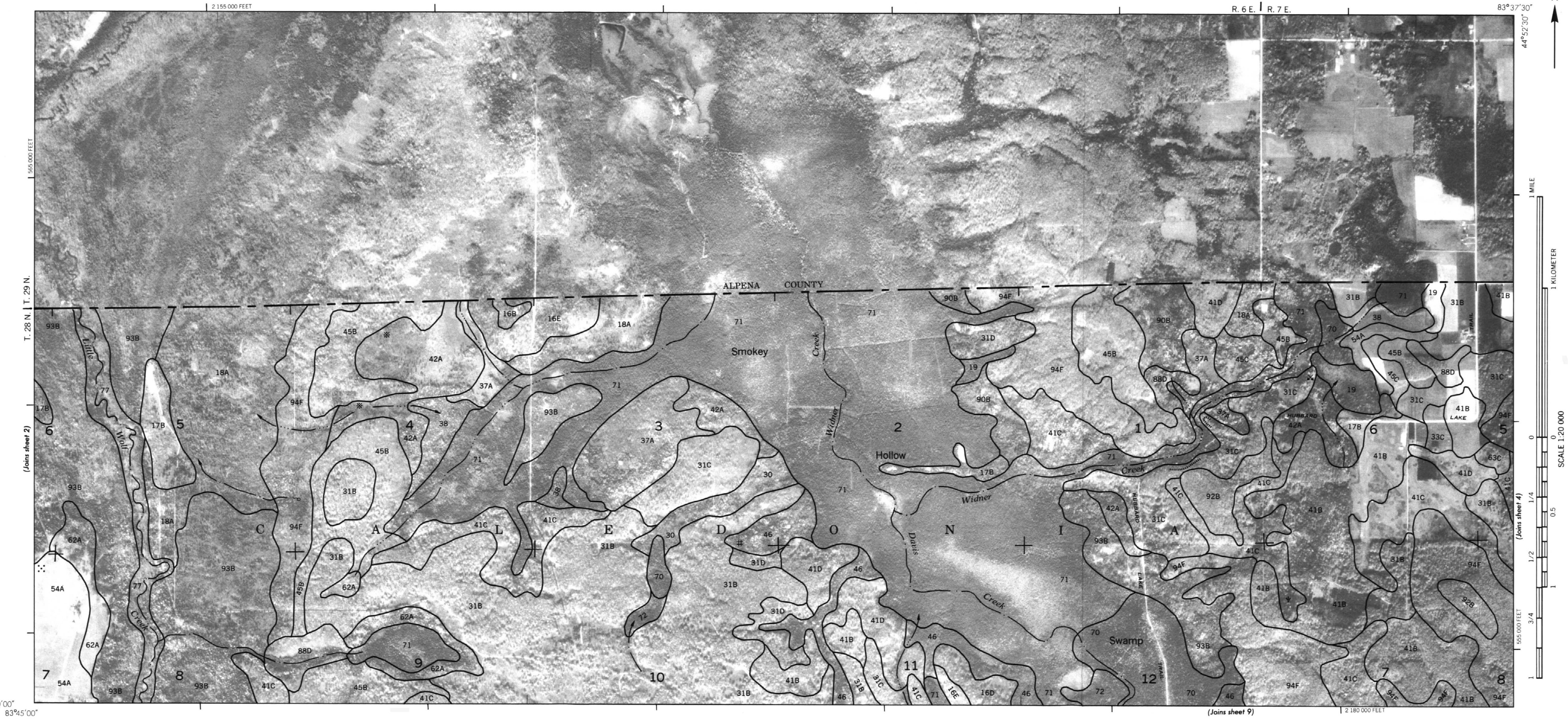
SOIL SAMPLE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Cut or fill spot < 5 Ac.
- Marl spot < 5 Ac.
- Loamy spot < 5 Ac.
- Muck spot < 5 Ac.


1
N
2 090 000 FEET
R. 4 E.
R. 5 E.
83°52'30"
44°52'30"
565 000 FEET
ALCONA COUNTY, MICHIGAN NO. 1
ALPENA COUNTY
FLYNN VALLEY ROAD
T. 28 N.
T. 29 N.
41C
94F
90B
31B
37A
6
OSCODA COUNTY
16B
16D
AU SABLE STATE FOREST
MITCHELL
7
33B
33C
1 MILE
1 KILOMETER
SCALE 1:20 000
(Joins sheet 2)
555 000 FEET
44°50'00"
84°00'00"
2 115 000 FEET
(Joins sheet 7)

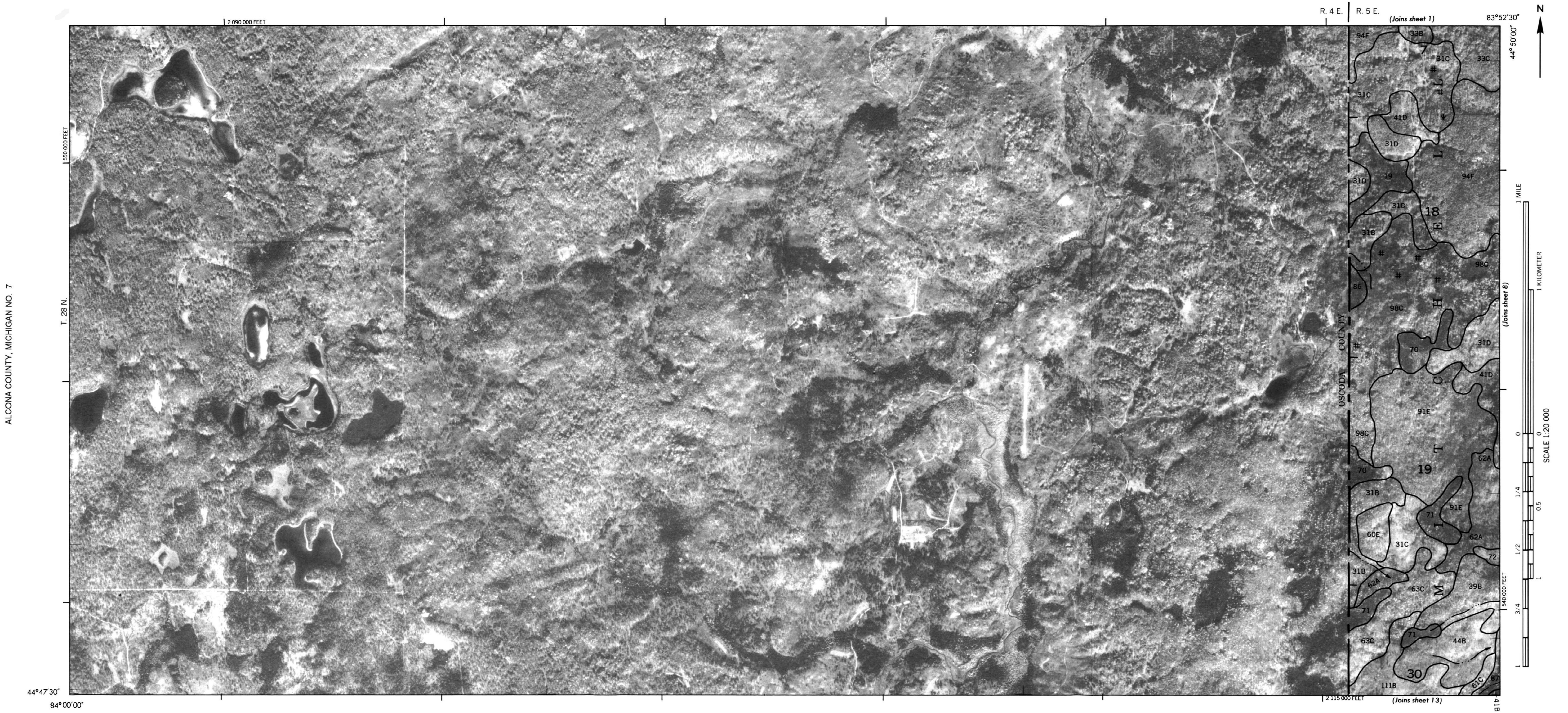

N
83°52′30″
44°52′30″
R. 5 E. | R. 6 E.
2 150 000 FEET
565 000 FEET
T. 28 N. | T. 29 N.
1 MILE
1 KILOMETER
SCALE 1:20 000
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 8)
555 000 FEET
2 120 000 FEET
44°50′00″
83°45′00″
ALPENA COUNTY
FLYNN VALLEY ROAD
VALLEY
FLYNN
ROAD
Indian Creek
McGinn Creek
MITCHELL
CALEDONIA

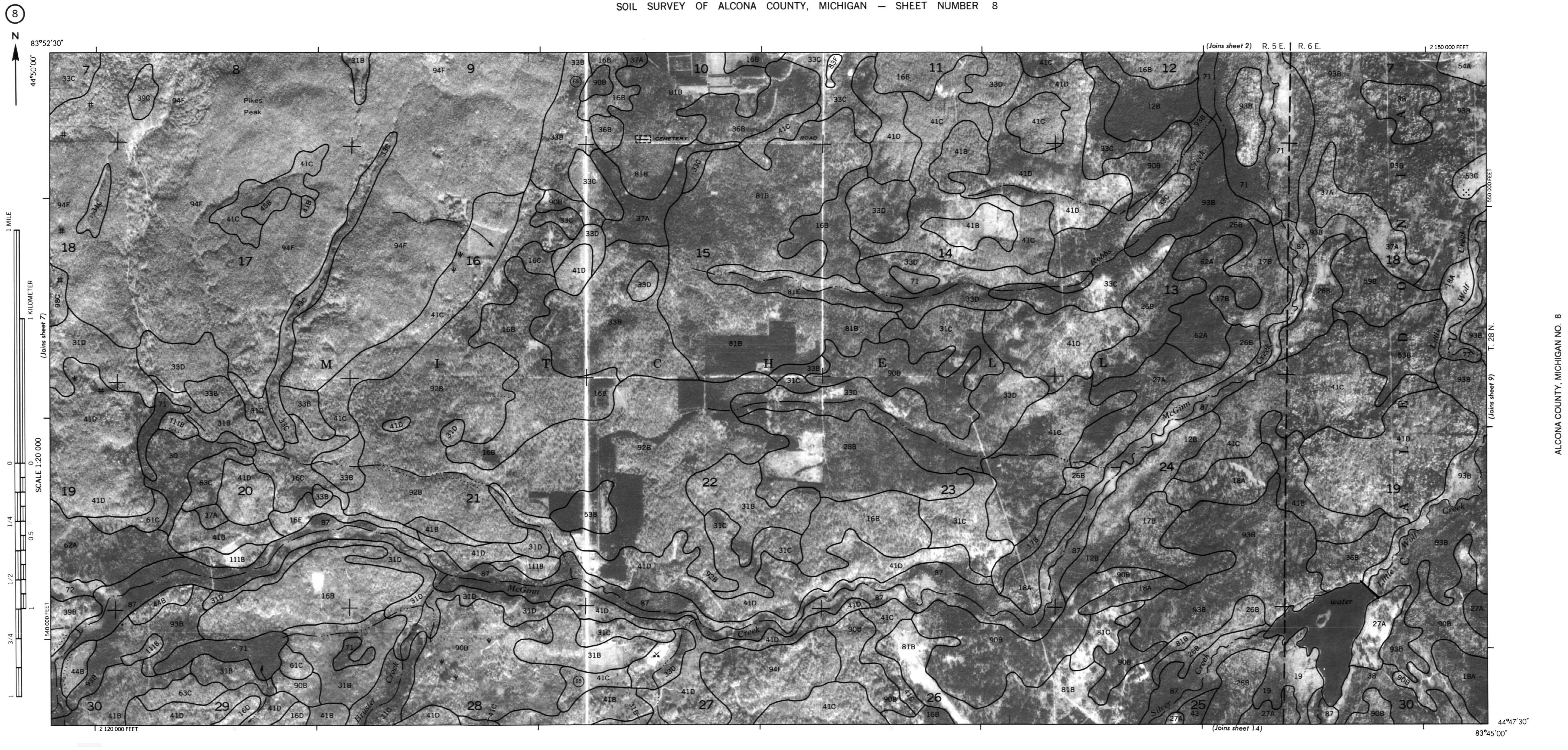

2 155 000 FEET
R. 6 E. | R. 7 E.
83°37'30"
44°52'30"
N
565 000 FEET
T. 28 N. | T. 29 N.
ALPENA COUNTY
Smokey
Hollow
Swamp
Little Wolf Creek
Widner Creek
Davis Creek
Creek
Widner
CALEDONIA
HUBBARD LAKE
TRAIL
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 9)
44°50'00"
83°45'00"
555 000 FEET
2 180 000 FEET
1 MILE
1 KILOMETER
SCALE 1:20 000


4
N
83°37′30″
44°52′30″
R. 7 E. | R. 8 E.
2 215 000 FEET
565 000 FEET
T. 29 N.
T. 28 N.
1 MILE
1 KILOMETER
SCALE 1:20 000
0
1/4
1/2
3/4
1
0.5
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 10)
555 000 FEET
2 185 000 FEET
44°50′00″
83°30′00″
ALPENA COUNTY
HUBBERT ROAD
North Bay
HUBBARD LAKE
C A L E D O N I A
MT. MARIA ROAD
Doctors Point
Hickey Hill
HUBBARD LAKE ROAD
North Branch Holcomb Creek
Holcomb Creek
1 2 3 4 5 6 7 8 9 10 11 12


5
N
2 220 000 FEET
R. 8 E.
R. 9 E.
83° 22′30″
44° 52′30″
565 000 FEET
T. 29 N.
T. 28 N.
ALPENA COUNTY
ALCONA COUNTY, MICHIGAN NO. 5
AU SABLE STATE FOREST
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 11)
South Branch
Devils River
Butternut Creek
Spruce
HUBBERT ROAD
SPRUCE ROAD
GILLARD ROAD
BARLOW ROAD
A L C O N A
A L C O N A
1 MILE
1 KILOMETER
SCALE 1:20 000
555 000 FEET
2 245 000 FEET
44° 50′00″
83° 30′00″

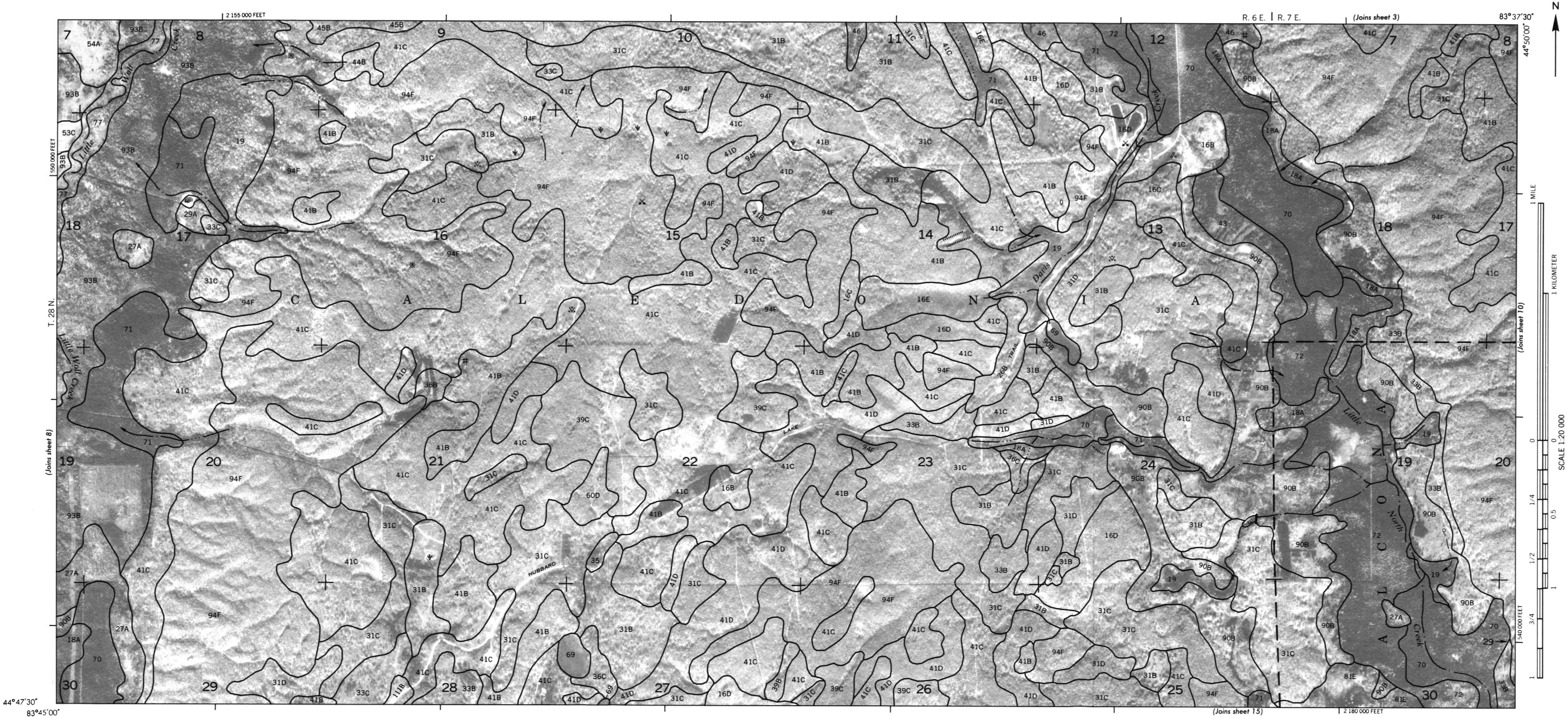
6
N
83° 22′30″
44° 52′30″
R. 9 E.
2 280 000 FEET
565 000 FEET
T. 29 N.
T. 28 N.
1 MILE
1 KILOMETER
SCALE 1:20 000
0
1/4
0.5
1/2
1
3/4
555 000 FEET
2 250 000 FEET
(Joins sheet 5)
(Joins sheet 12)
44°50′00″
83° 15′00″
L A K E H U R O N
ALPENA COUNTY
NEGWEGON
STATE FOREST
STATE PARK
AU SABLE
Black River Swamp
North Branch
Black River
Butternut Creek
5
4
3
2
8
9
10
11
70
71
72
12B
11B
29A
28B
18A
19
93B
78


7
N
2 090 000 FEET
R. 4 E.
R. 5 E.
(Joins sheet 1)
83°52'30"
44°50'00"
550 000 FEET
T. 28 N.
ALCONA COUNTY, MICHIGAN NO. 7
OSCODA COUNTY
(Joins sheet 8)
540 000 FEET
44°47'30"
84°00'00"
2 115 000 FEET
(Joins sheet 13)
94F
33B
31C
33C
41D
31D
19
94F
31C
18
31B
98C
86
98C
70
31D
41D
91E
98C
19
62A
70
31B
71
91E
60E
31C
62A
72
31B
62A
63C
39B
71
71
44B
63C
30
111B
61C
87
41B
1 MILE
1 KILOMETER
SCALE 1:20 000
0
1/4
1/2
3/4
1
0
0.5
1

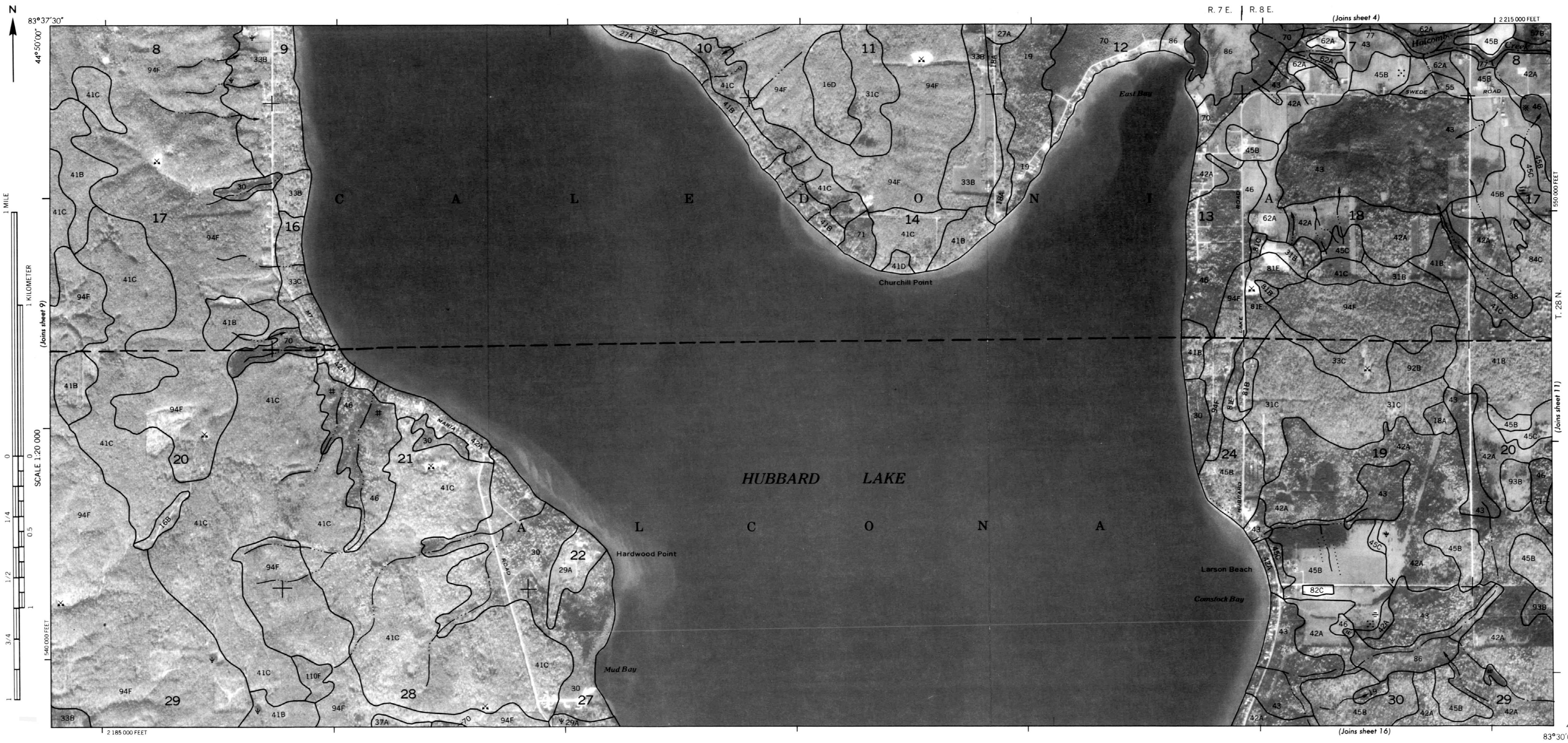


8
N
83°52'30"
44°50'00"
(Joins sheet 2)
R. 5 E.
R. 6 E.
2 150 000 FEET
550 000 FEET
(Joins sheet 7)
(Joins sheet 9)
T. 28 N.
MITCHELL
IOSCO
Pikes Peak
CEMETERY
ROAD
Robbs Creek
McGinn Creek
Little Wolf Creek
Bruster Creek
Silver Creek
water
540 000 FEET
2 120 000 FEET
(Joins sheet 14)
44°47'30"
83°45'00"
1 MILE
1 KILOMETER
SCALE 1:20 000
ALCONA COUNTY, MICHIGAN NO. 8

ALCONA COUNTY, MICHIGAN NO. 9



SOIL SURVEY OF ALCONA COUNTY, MICHIGAN — SHEET NUMBER 10

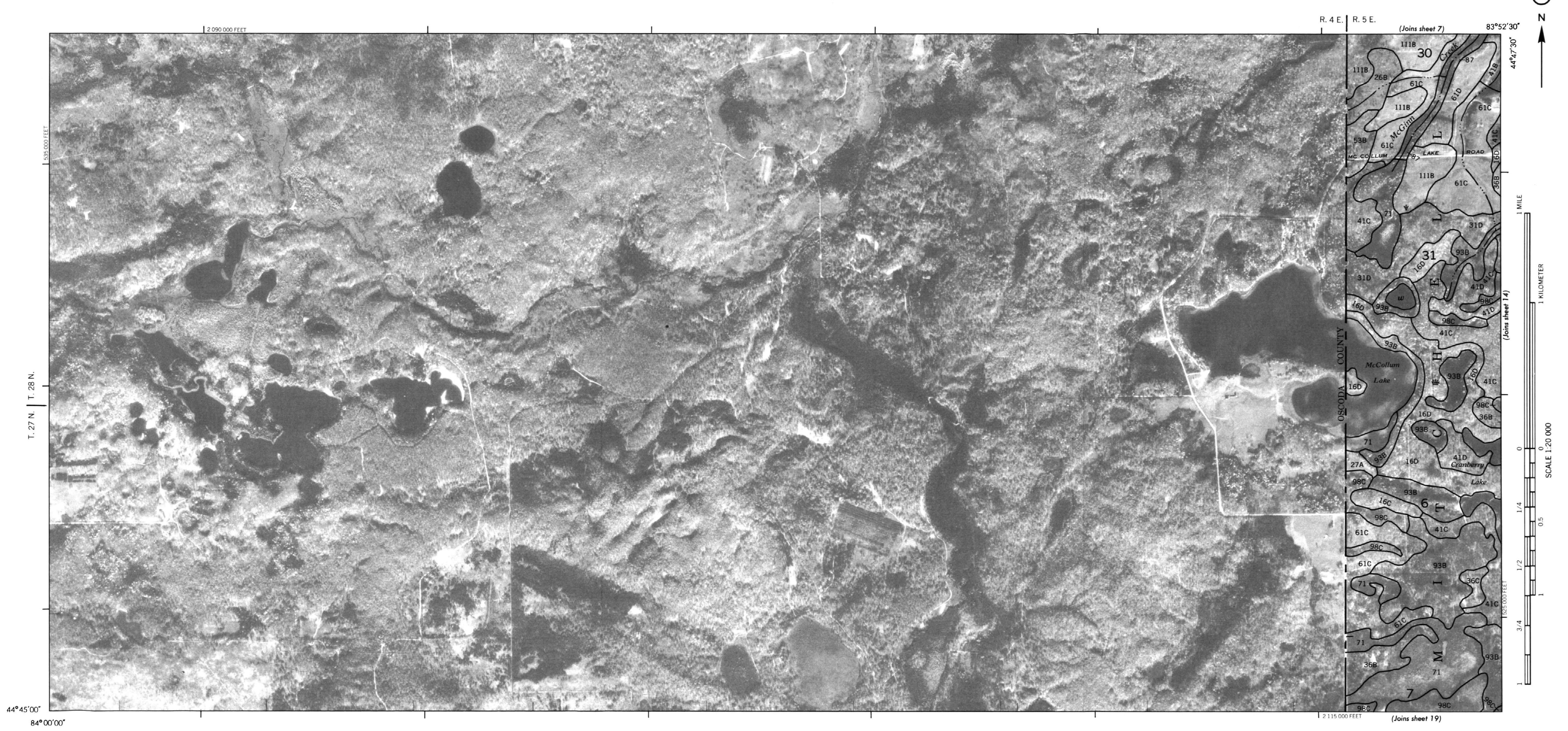


ALCONA COUNTY, MICHIGAN NO. 10

11

ALCONA COUNTY, MICHIGAN NO. 11


N
83°22'30"
44°50'00"
(Joins sheet 6)
R. 9 E.
2 280 000 FEET
NEGWEGON
STATE
PARK
Black River Swamp
AU SABLE
STATE
FOREST
Black River Island
Muskrat Lake
Black River
L A K E H U R O N
T. 28 N.
(Joins sheet 11)
HURON
A
L
C
O
N
A
NATIONAL
FOREST
(Joins sheet 18)
2 250 000 FEET
540 000 FEET
550 000 FEET
44°47'30"
83°15'00"
1 MILE
1 KILOMETER
SCALE 1:20 000
ALCONA COUNTY, MICHIGAN NO. 12


13
N
R. 4 E.
R. 5 E.
(Joins sheet 7)
83°52'30"
44°47'30"
2 090 000 FEET
535 000 FEET
T. 28 N.
T. 27 N.
ALCONA COUNTY, MICHIGAN NO. 13
(Joins sheet 14)
(Joins sheet 19)
2 115 000 FEET
525 000 FEET
44°45'00"
84°00'00"
OSCODA COUNTY
McCollum Lake
Cranberry Lake
McGinn Creek
MC COLLUM LAKE ROAD
L L E H C T I M
30
31
6
7
1 MILE
1 KILOMETER
SCALE 1:20 000

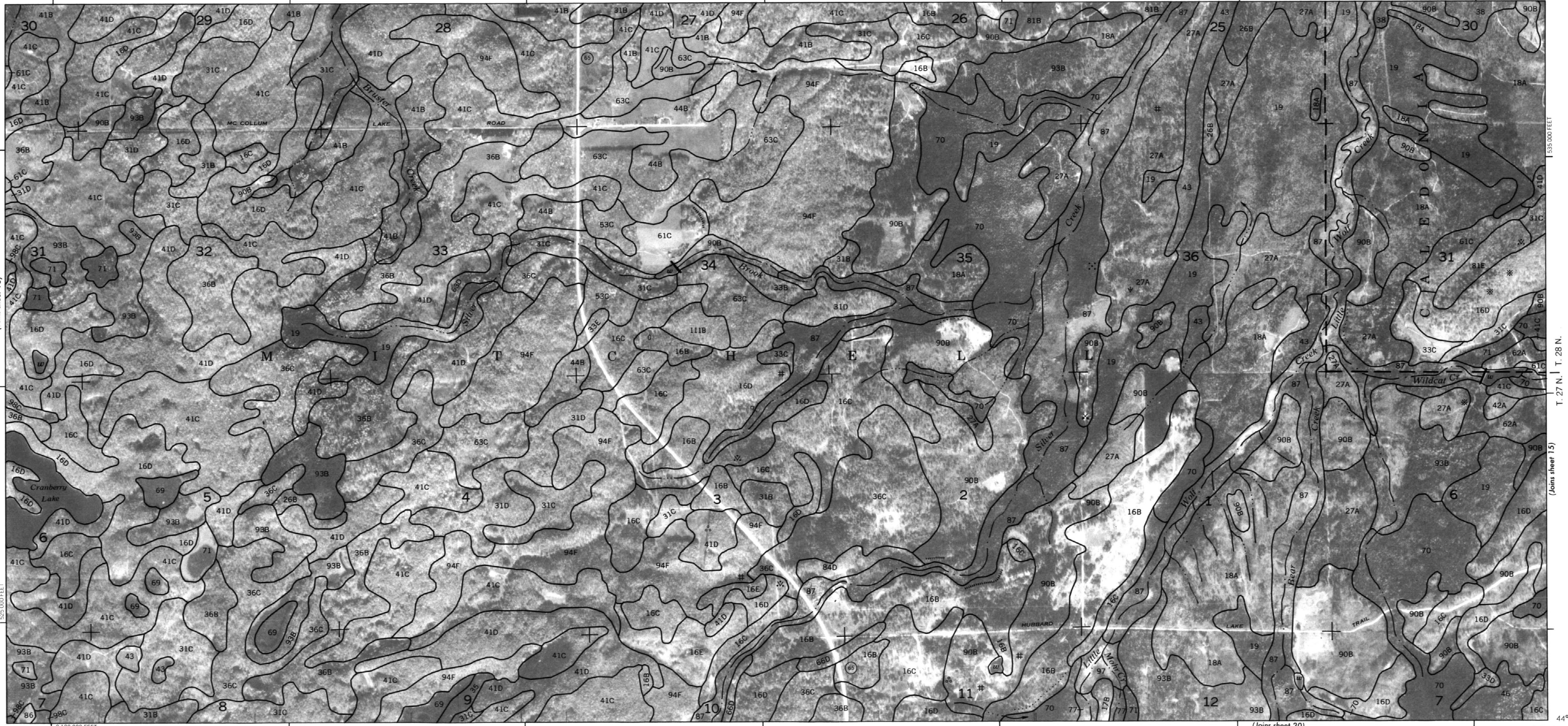
N

83°52'30"

44°47'30"

R. 5 E. | R. 6 E. (Joins sheet 8)

2 150 000 FEET



(Joins sheet 13)

(Joins sheet 15)

1 MILE

1 KILOMETER

SCALE 1:20 000

0 1/4 1/2 3/4 1

0 0.5 1

535 000 FEET

525 000 FEET

T. 28 N.

T. 27 N.

2 120 000 FEET

(Joins sheet 20)

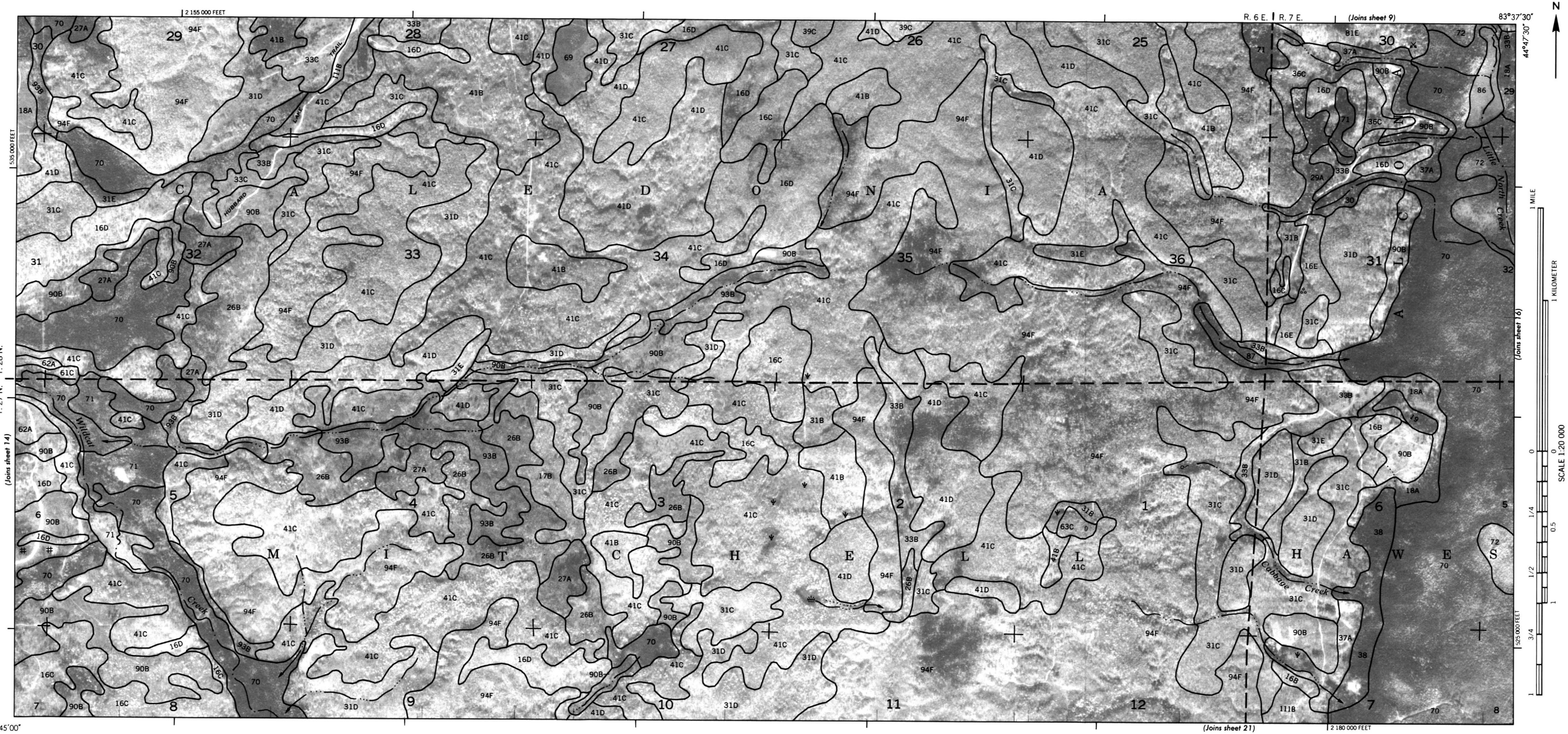
44°45'00"

83°45'00"

ALCONA COUNTY, MICHIGAN NO. 14

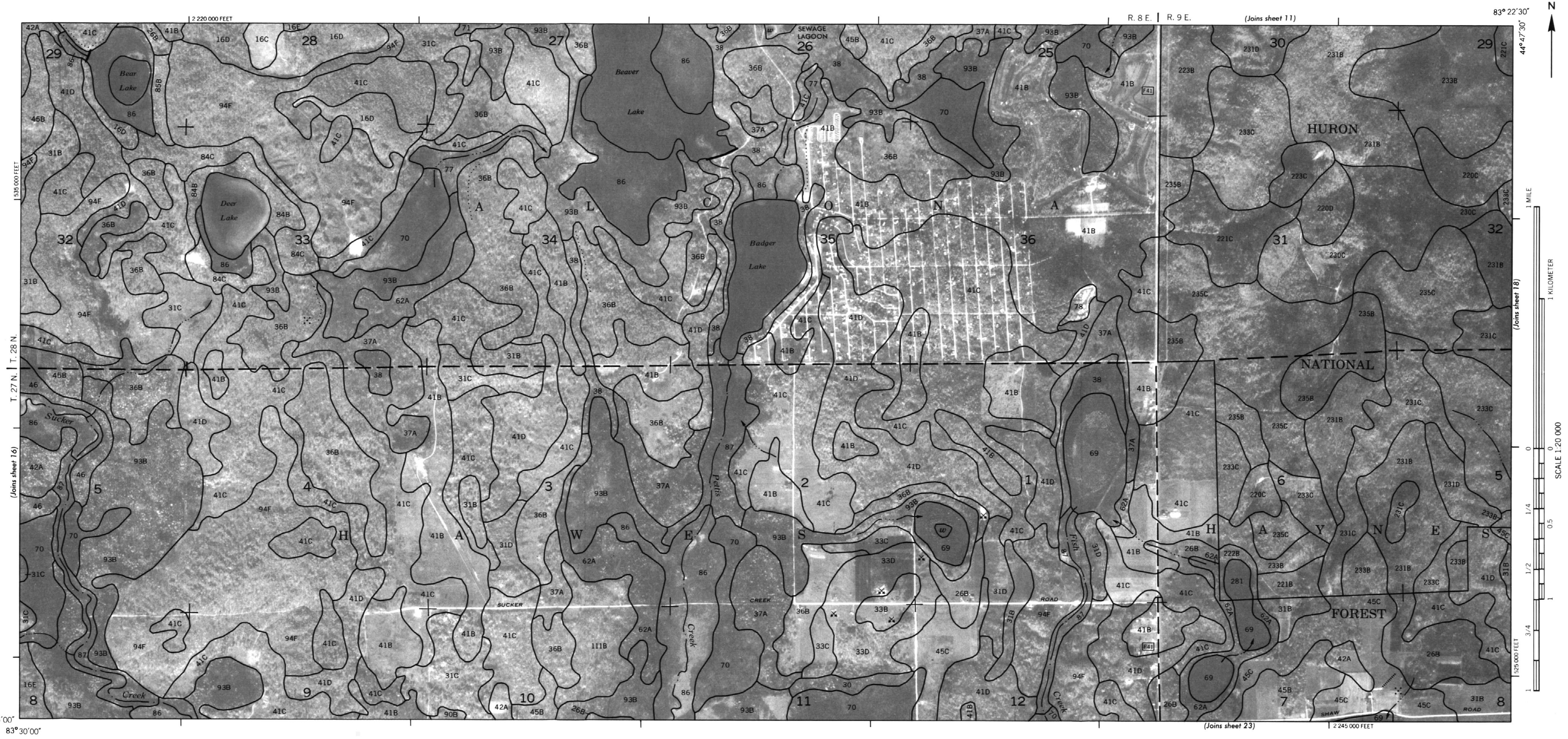
15

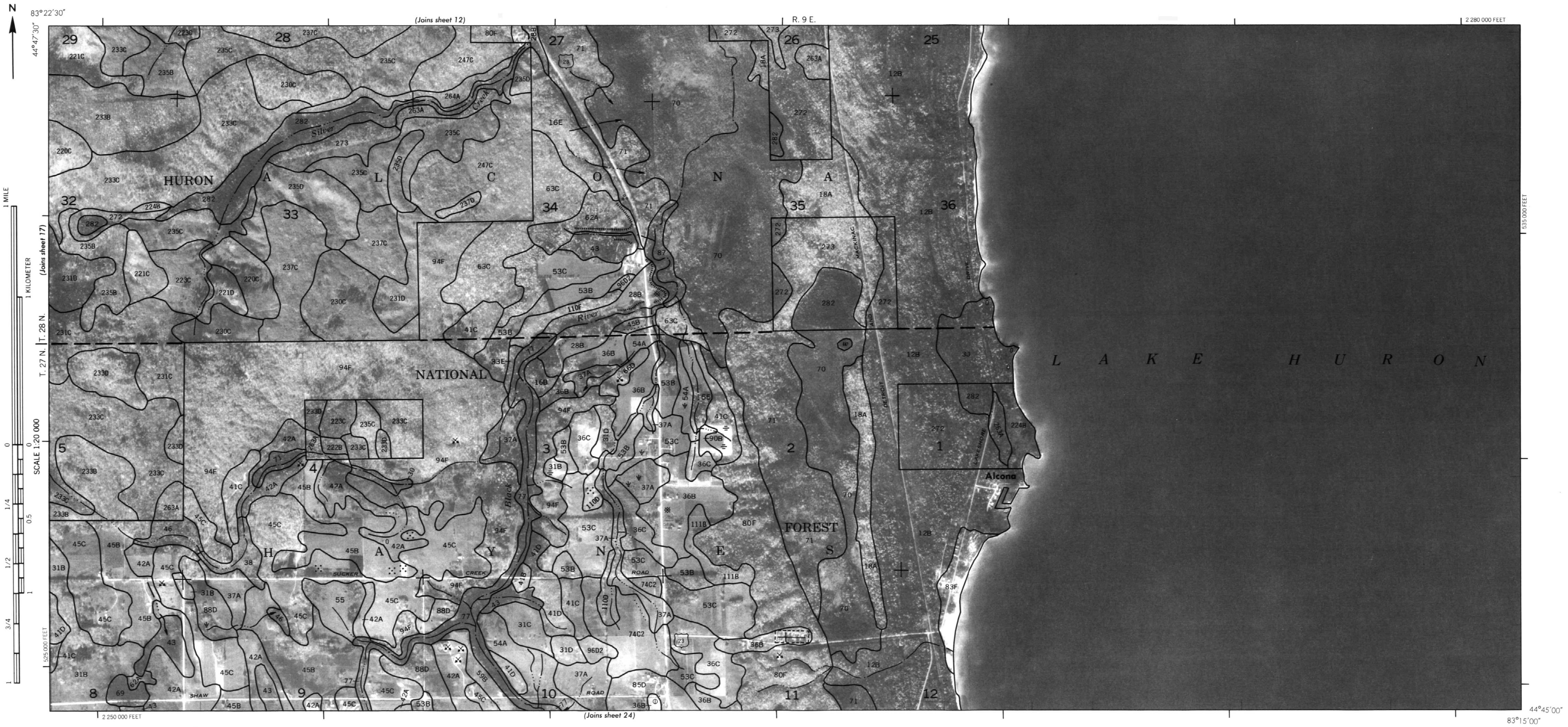
ALCONA COUNTY, MICHIGAN NO. 15

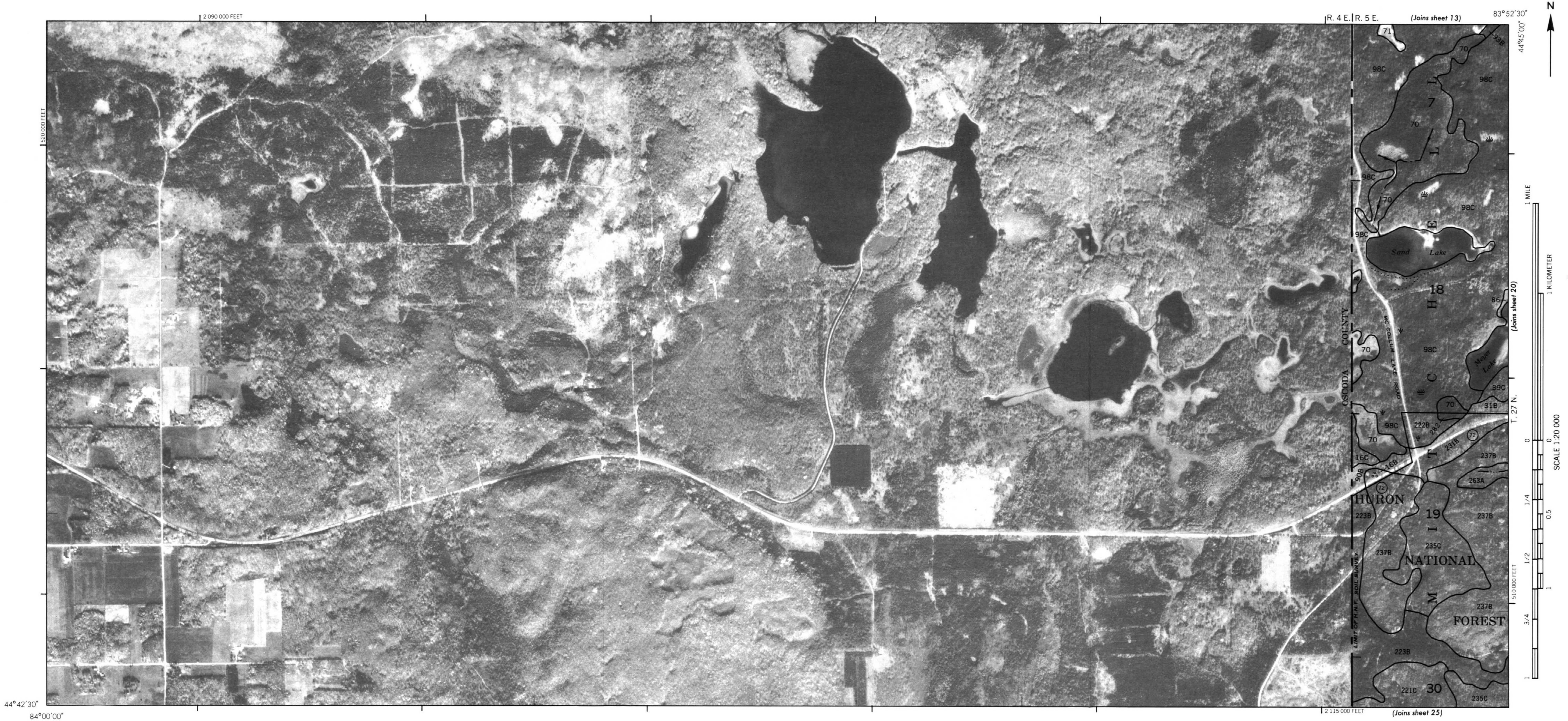


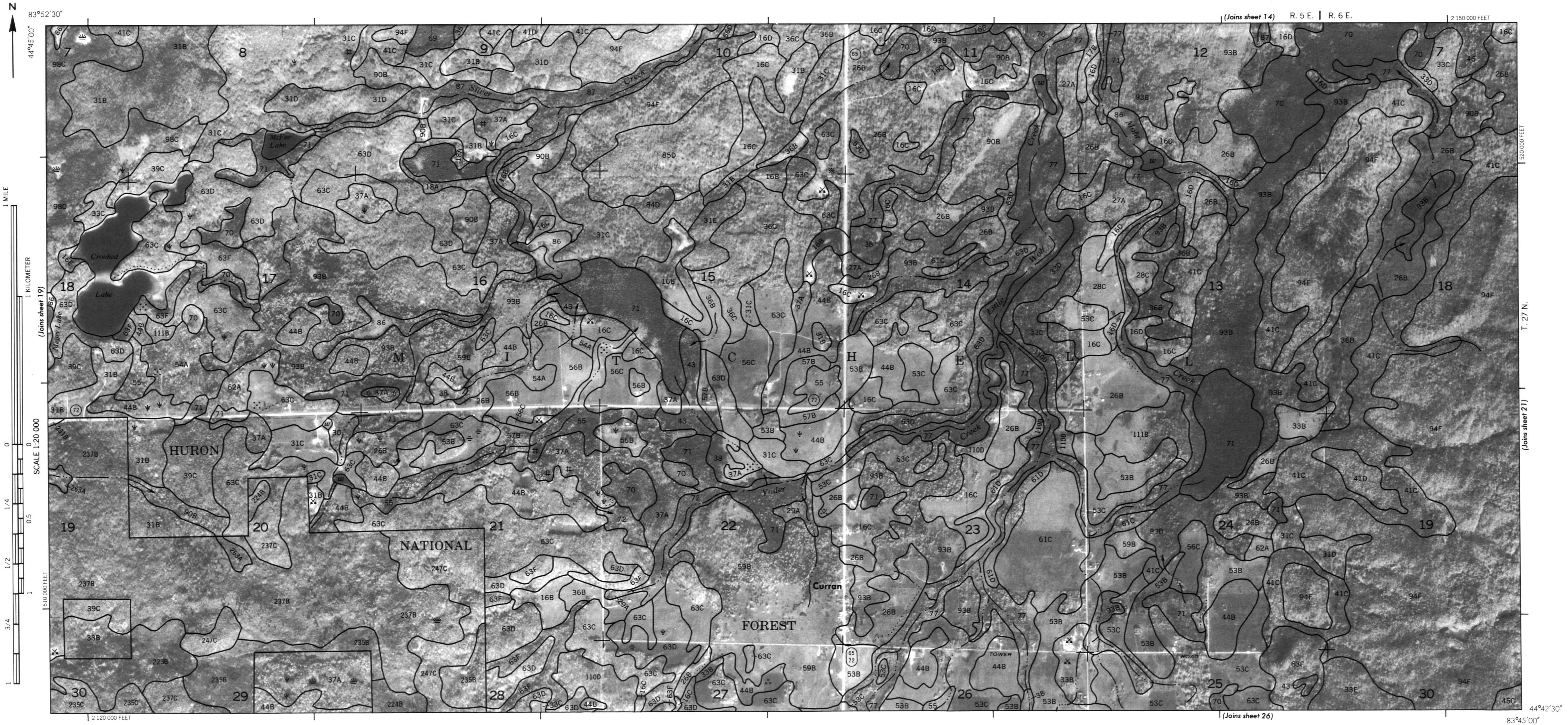
SOIL SURVEY OF ALCONA COUNTY, MICHIGAN — SHEET NUMBER 16

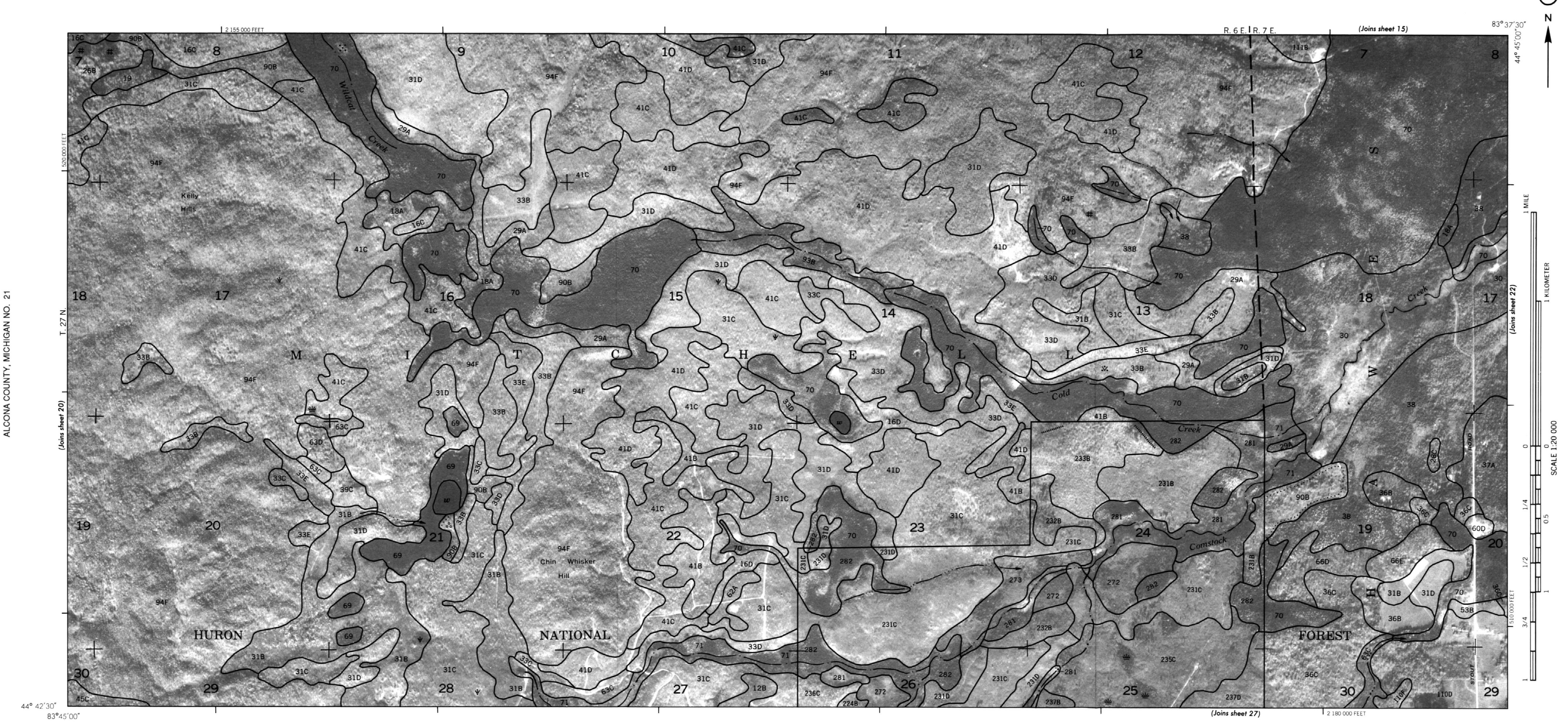
ALCONA COUNTY, MICHIGAN NO. 17

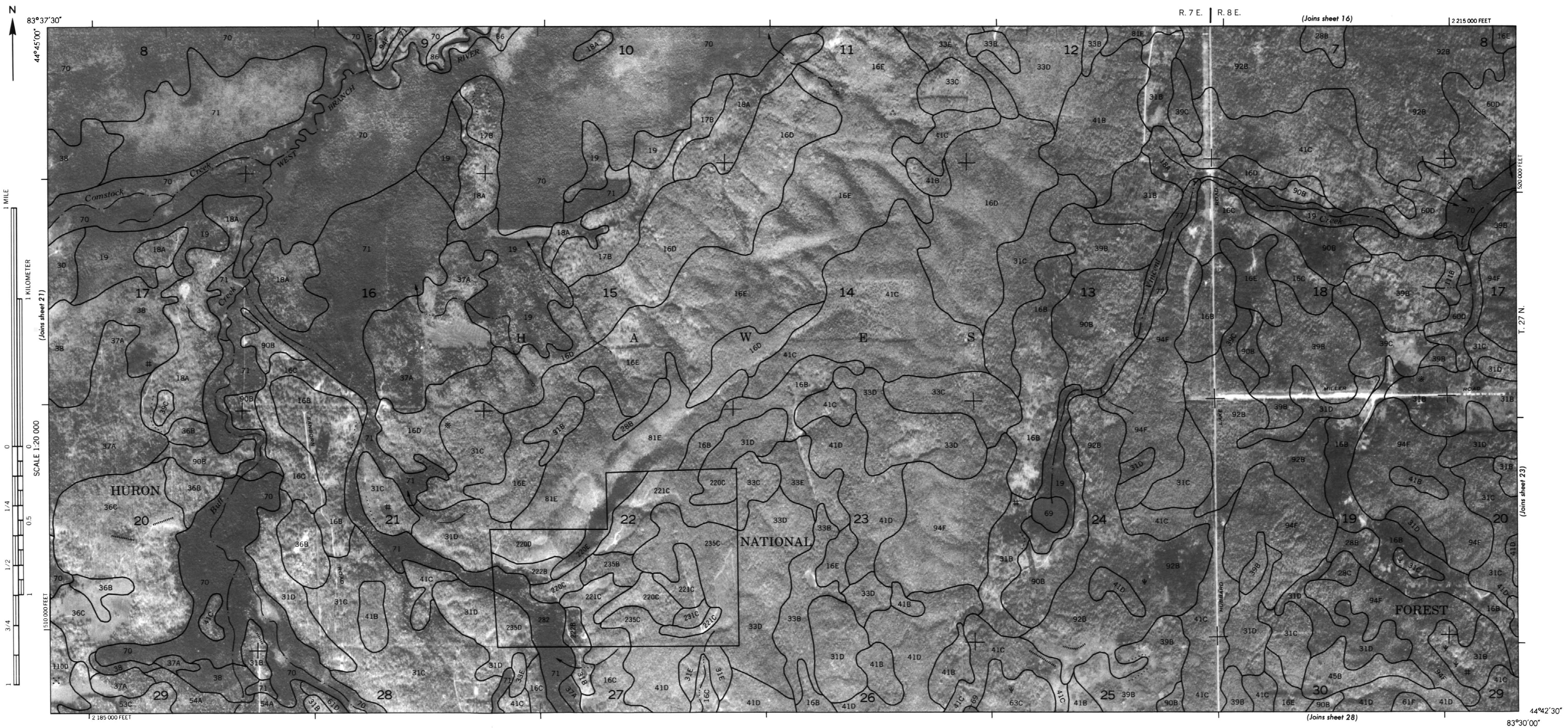



N
83°22'30"
44°47'30"
(Joins sheet 12)
R. 9 E.
2 280 000 FEET
535 000 FEET
(Joins sheet 17)
T. 28 N.
T. 27 N.
1 MILE
1 KILOMETER
SCALE 1:20 000
0
1/4
1/2
3/4
1
0.5
525 000 FEET
2 250 000 FEET
(Joins sheet 24)
44°45'00"
83°15'00"
HURON
NATIONAL
FOREST
L A K E H U R O N
Alcona
Silver Creek
Black River
SUCKER CREEK ROAD
SHAW ROAD
MACKINAC
DETROIT
LAKESHORE
DRIVE
29
28
27
26
25
32
33
34
35
36
5
4
3
2
1
8
9
10
11
12


19
N
2 090 000 FEET
R. 4 E.
R. 5 E.
(Joins sheet 13)
83°52'30"
44°45'00"
520 000 FEET
Sand Lake
Meyer Lake
(Joins sheet 20)
T. 27 N.
OSCODA COUNTY
MC COLLUM LAKE ROAD
HURON
NATIONAL
FOREST
LIMIT OF H.N.F. SOIL SURVEY
72
7
18
19
30
98C
70
71
98B
86
39C
31B
222B
231B
237B
263A
16C
16B
223B
235C
221C
90
510 000 FEET
2 115 000 FEET
(Joins sheet 25)
44°42'30"
84°00'00"
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0.5
SCALE 1:20 000


20
N
83°52'30"
44°45'00"
(Joins sheet 14)
R. 5 E. | R. 6 E.
2 150 000 FEET
520 000 FEET
T. 27 N.
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 26)
2 120 000 FEET
510 000 FEET
44°42'30"
83°45'00"
1 MILE
1 KILOMETER
SCALE 1:20 000
HURON
NATIONAL
FOREST
McFee Lake
Crooked Lake
Silver Creek
Little Wolf Creek
Wolf Creek
Yoder
Curran
TOWER
ROAD
M I T C H E L L

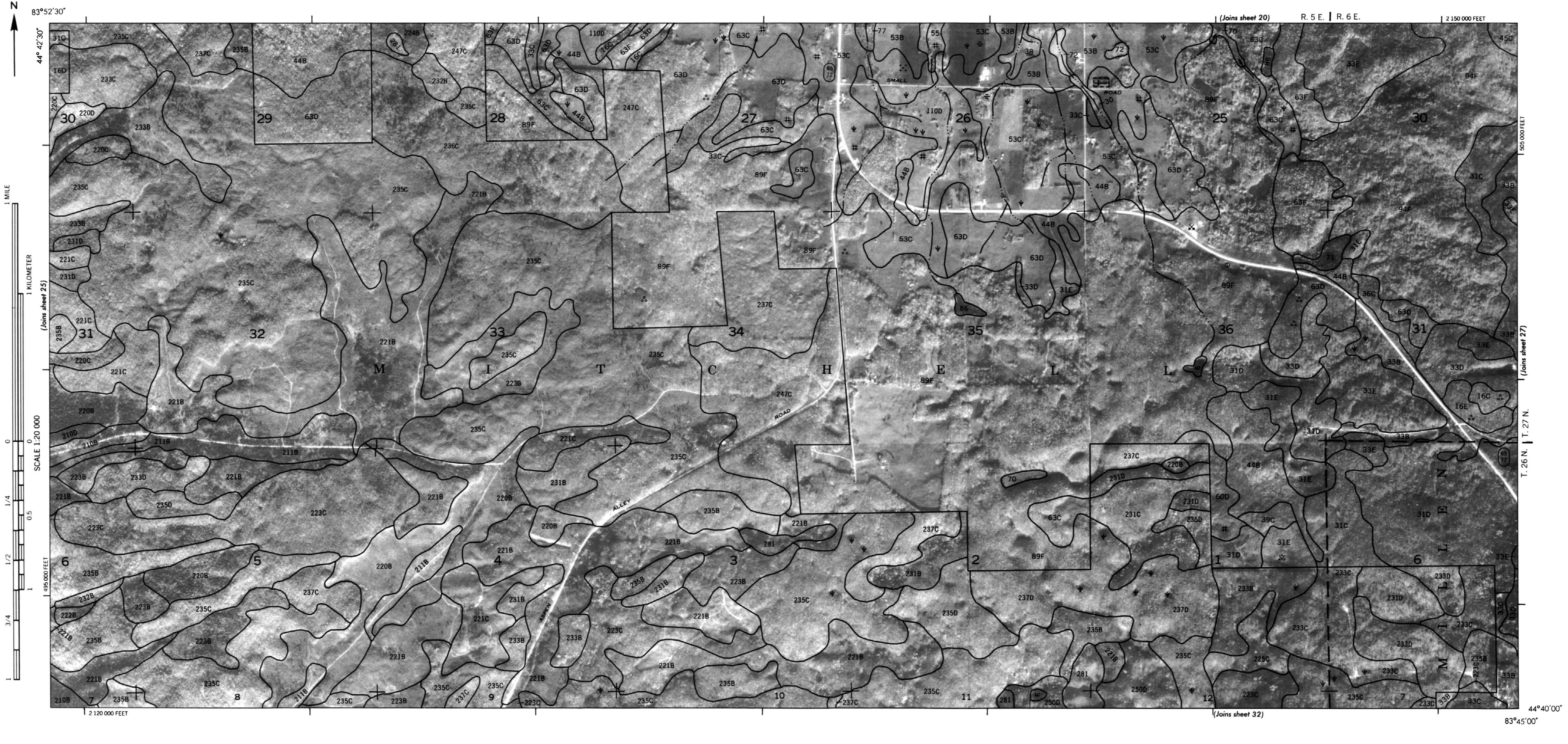

21
N
2 155 000 FEET
R. 6 E. R. 7 E.
(Joins sheet 15)
83°37'30"
44°45'00"
520 000 FEET
T. 27 N.
ALCONA COUNTY, MICHIGAN NO. 21
(Joins sheet 20)
(Joins sheet 22)
Kelly Hills
Wildcat Creek
Cold Creek
Comstock
Chin Whisker Hill
HURON
NATIONAL
FOREST
STOUT ROAD
1 MILE
1 KILOMETER
SCALE 1:20 000
510 000 FEET
(Joins sheet 27)
2 180 000 FEET
44°42'30"
83°45'00"

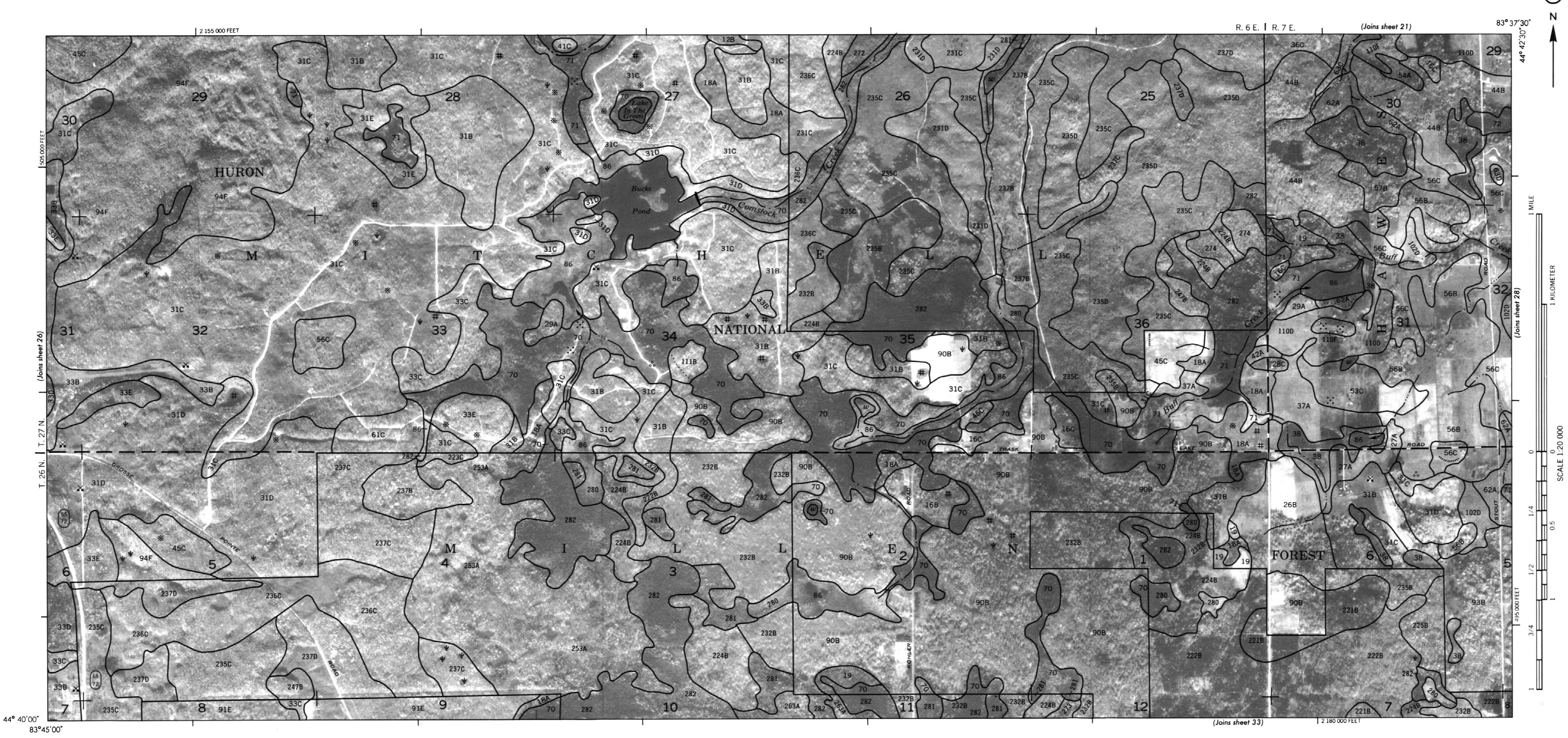

22
N
83°37'30"
44°45'00"
R. 7 E. | R. 8 E.
(Joins sheet 16)
2 215 000 FEET
520 000 FEET
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 28)
T. 27 N.
1 MILE
1 KILOMETER
SCALE 1:20 000
0
1/4
0.5
1/2
3/4
1
510 000 FEET
2 185 000 FEET
44°42'30"
83°30'00"
HURON
NATIONAL
FOREST
H A W E S
Comstock Creek
WEST BRANCH RIVER
Bulls Creek
Vincent Creek
MILLER ROAD
LAKE ROAD
HUBBARD ROAD
SANBORN ROAD
8
9
10
11
12
7
16
15
14
13
18
17
20
21
22
23
24
19
29
28
27
26
25
30

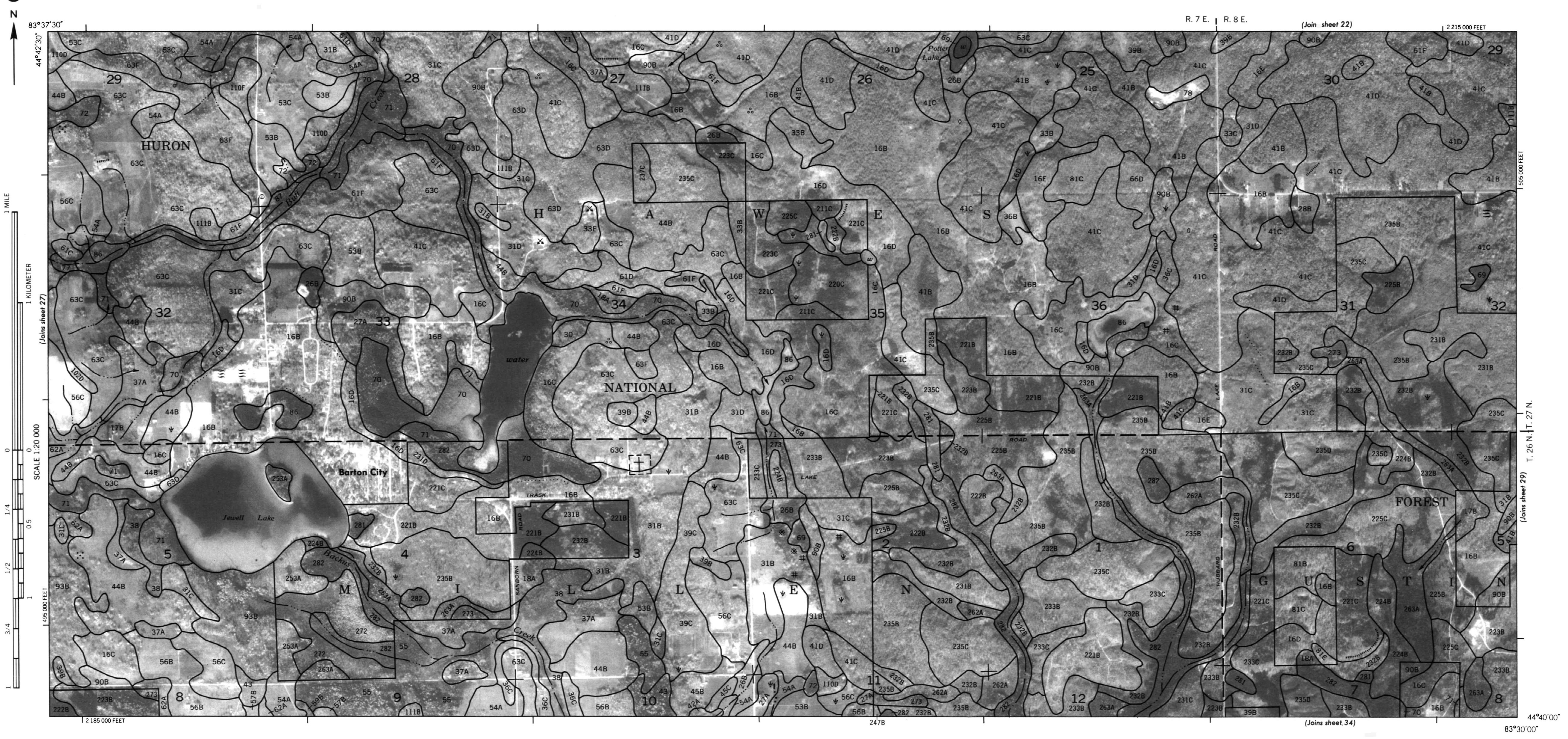

23
N
(Joins sheet 17)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 29)
ALCONA COUNTY, MICHIGAN NO. 23
T. 27 N.
R. 8 E.
R. 9 E.
83° 22′30″
44° 45′00″
44° 42′30″
83° 30′00″
2 220 000 FEET
2 245 000 FEET
520 000 FEET
510 000 FEET
HURON NATIONAL FOREST
SCALE 1:20 000
1 MILE
1 KILOMETER
Vincent Creek
Sucker Creek
Fish Creek
Potts Creek
Millikin Lake
MILLER ROAD
BEATON ROAD
QUICK ROAD
MC NEIL ROAD
BARLOW ROAD
SOMERS ROAD

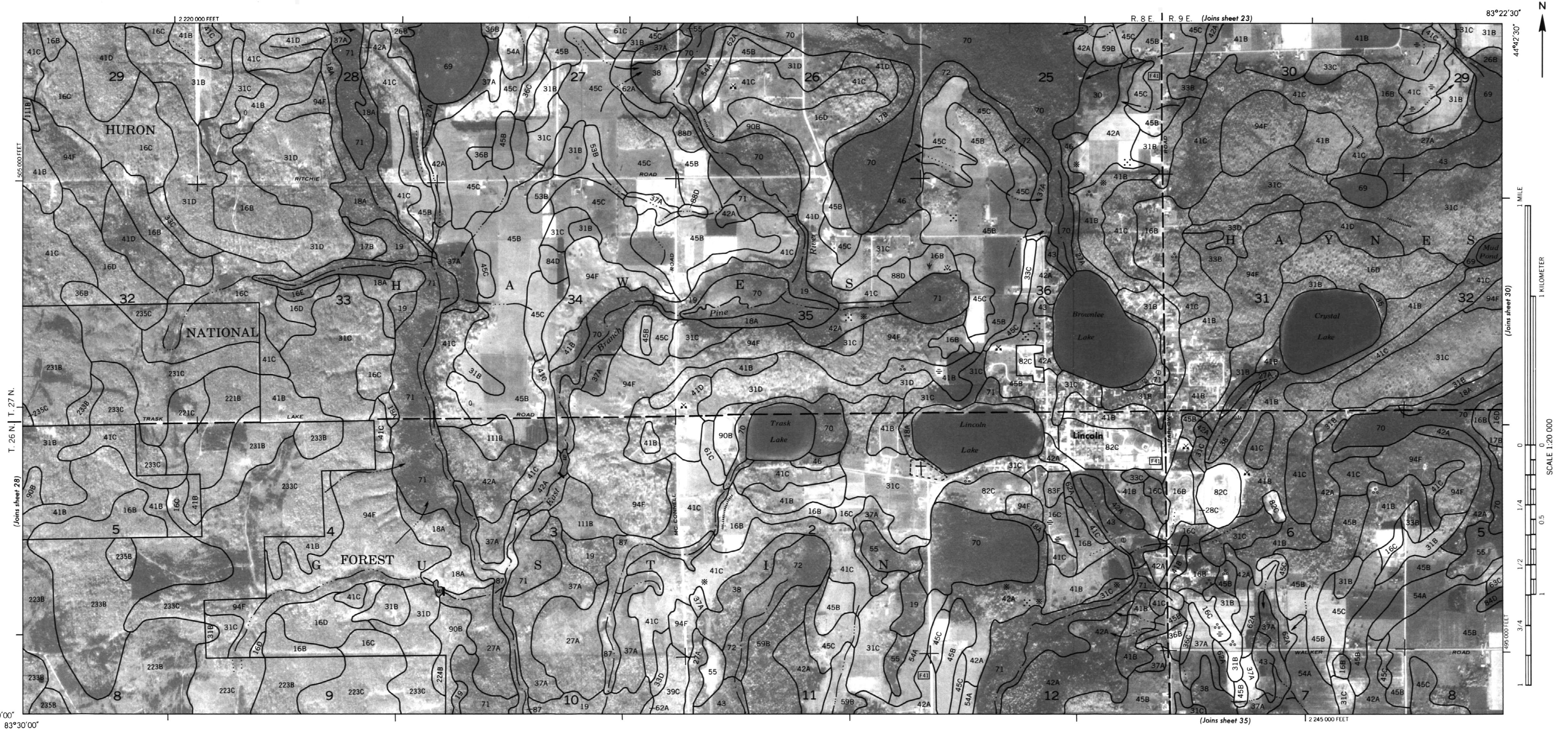

N
83°22′30″
44°45′00″
(Joins sheet 18)
R. 9 E. | R. 10 E.
2 280 000 FEET
520 000 FEET
(Joins sheet 23)
T. 27 N.
SCALE 1:20 000
1 MILE
1 KILOMETER
510 000 FEET
2 250 000 FEET
(Joins sheet 30)
44°42′30″
83°15′00″
L A K E H U R O N
Sturgeon Point
MC NEIL ROAD
BEATON ROAD
QUICK ROAD
Haines Creek
Black River
MC GREGOR ROAD
FARM ROAD
DETROIT AND MACKINAC DRIVE

ALCONA COUNTY, MICHIGAN NO. 25

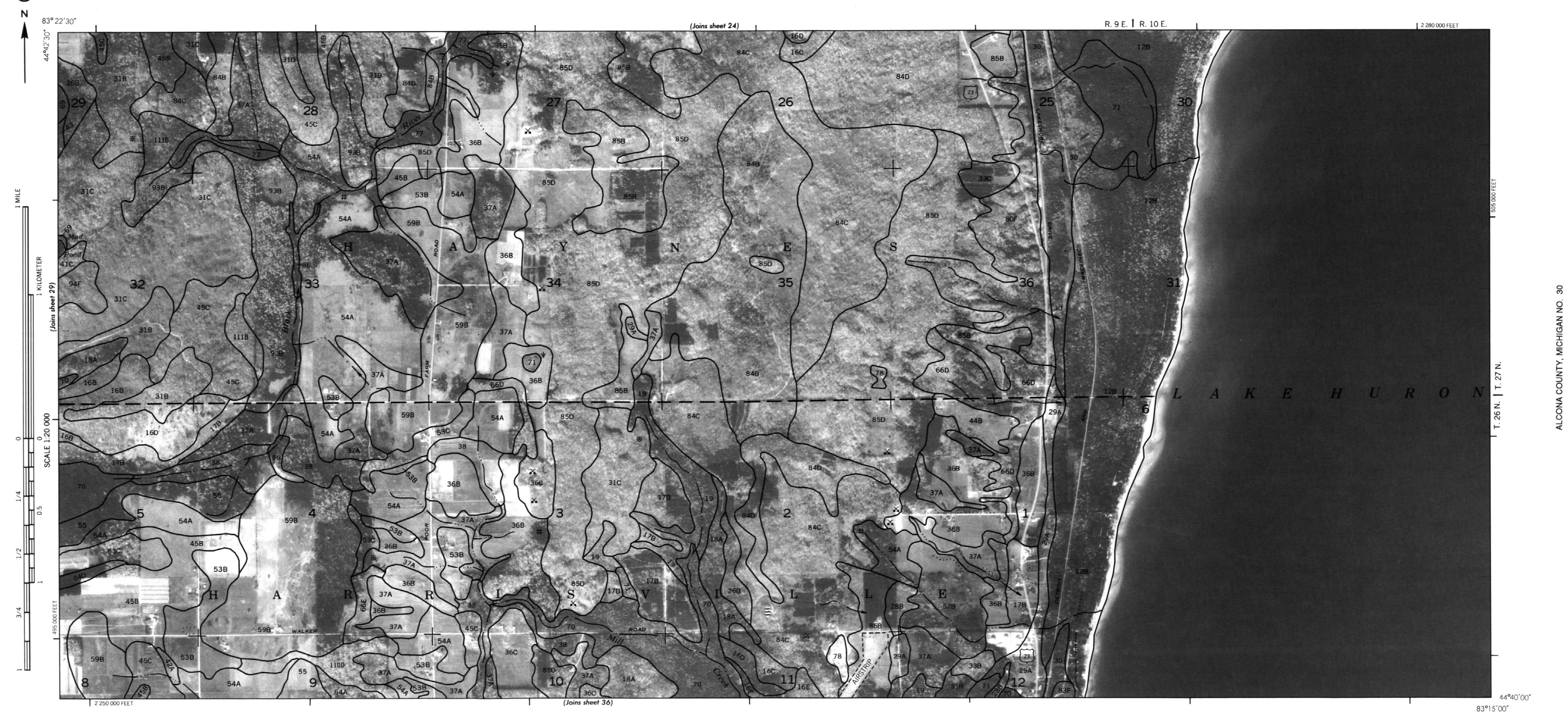

26
N
83°52'30"
44°42'30"
(Joins sheet 20)
R. 5 E. | R. 6 E.
2 150 000 FEET
505 000 FEET
(Joins sheet 25)
(Joins sheet 27)
T. 27 N.
T. 26 N.
495 000 FEET
2 120 000 FEET
(Joins sheet 32)
44°40'00"
83°45'00"
1 MILE
1 KILOMETER
SCALE 1:20 000
SMALL ROAD
ALLEY ROAD
ASPEN
M I T C H E L L
M I L L E N
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
7
8
9
10
11
12


27
N
ALCONA COUNTY, MICHIGAN NO. 27
2 155 000 FEET
2 180 000 FEET
505 000 FEET
495 000 FEET
R. 6 E. | R. 7 E.
T. 27 N.
T. 26 N.
(Joins sheet 21)
(Joins sheet 26)
(Joins sheet 28)
(Joins sheet 33)
83° 37′30″
44° 42′30″
44° 40′00″
83°45′00″
HURON
NATIONAL
FOREST
M I T C H E L L
M I L L E N
Bucks Pond
Lake In The Green
Comstock Creek
Buff Creek
WASH
GROSSE POINTE
TRASK LAKE ROAD
KOHLER ROAD
STOUT ROAD
ROAD
1 MILE
1 KILOMETER
SCALE 1:20 000


28
N
83°37'30"
44°42'30"
R. 7 E. | R. 8 E.
(Join sheet 22)
2 215 000 FEET
505 000 FEET
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 34)
T. 27 N.
T. 26 N.
2 185 000 FEET
495 000 FEET
44°40'00"
83°30'00"
1 MILE
1 KILOMETER
SCALE 1:20 000
HURON
NATIONAL
FOREST
Barton City
Jewell Lake
water
Potter Lake
Creek
Backus
TRASK
ROAD
LAKE
HUBBARD
SANBORN

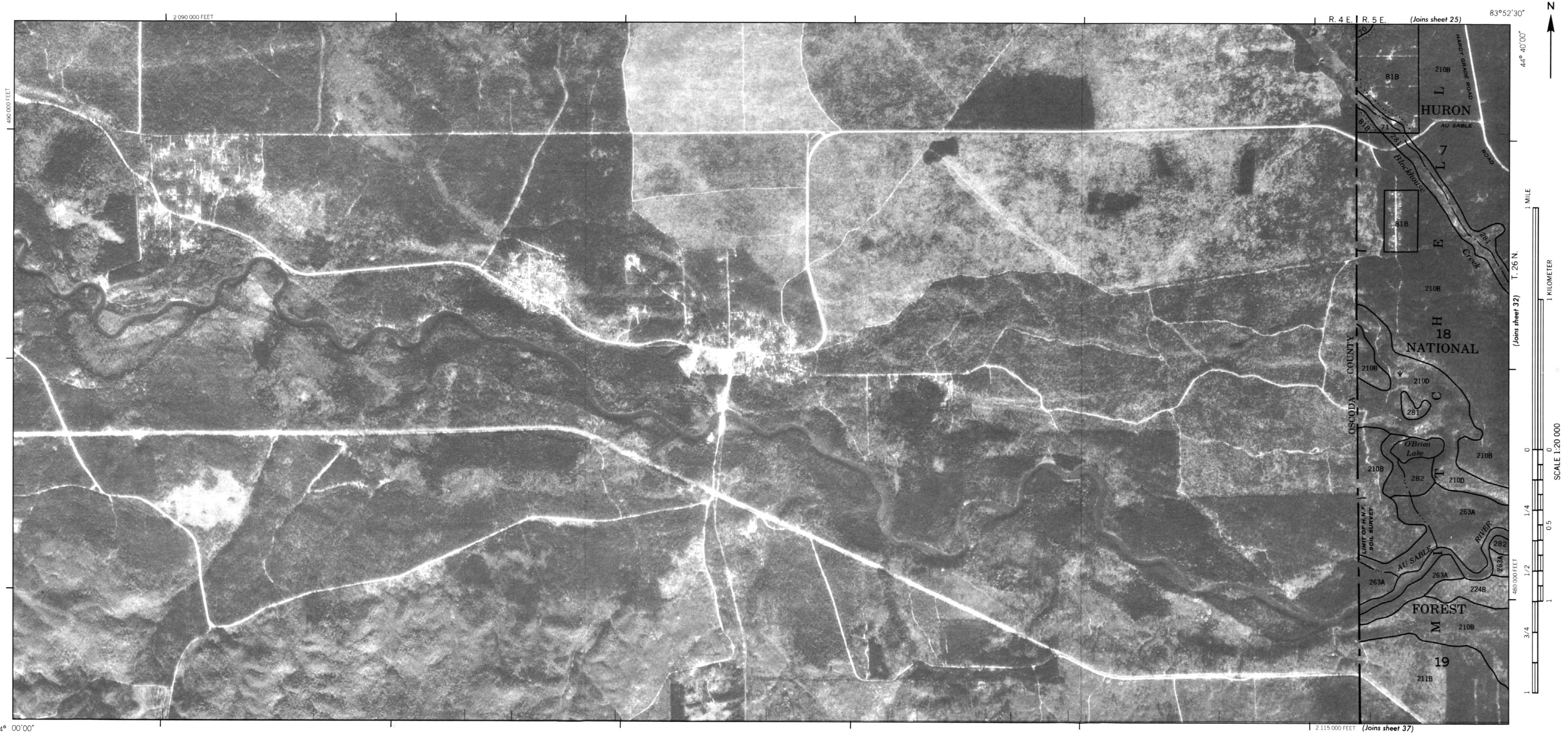


ALCONA COUNTY, MICHIGAN NO. 29


30
N
(Joins sheet 24)
R. 9 E. | R. 10 E.
(Joins sheet 36)
(Joins sheet 29)
LAKE HURON
HAYNES
HARRISVILLE
T. 27 N.
T. 26 N.
SCALE 1:20 000
1 MILE
1 KILOMETER
83°22′30″
44°42′30″
44°40′00″
83°15′00″
2 250 000 FEET
2 280 000 FEET
495 000 FEET
505 000 FEET
Mud Pond
Black River
Mill Creek
FARM ROAD
POOR
WALKER ROAD
AIRSTRIP
LAKESHORE DRIVE
MACKINAC AND DETROIT
23

31

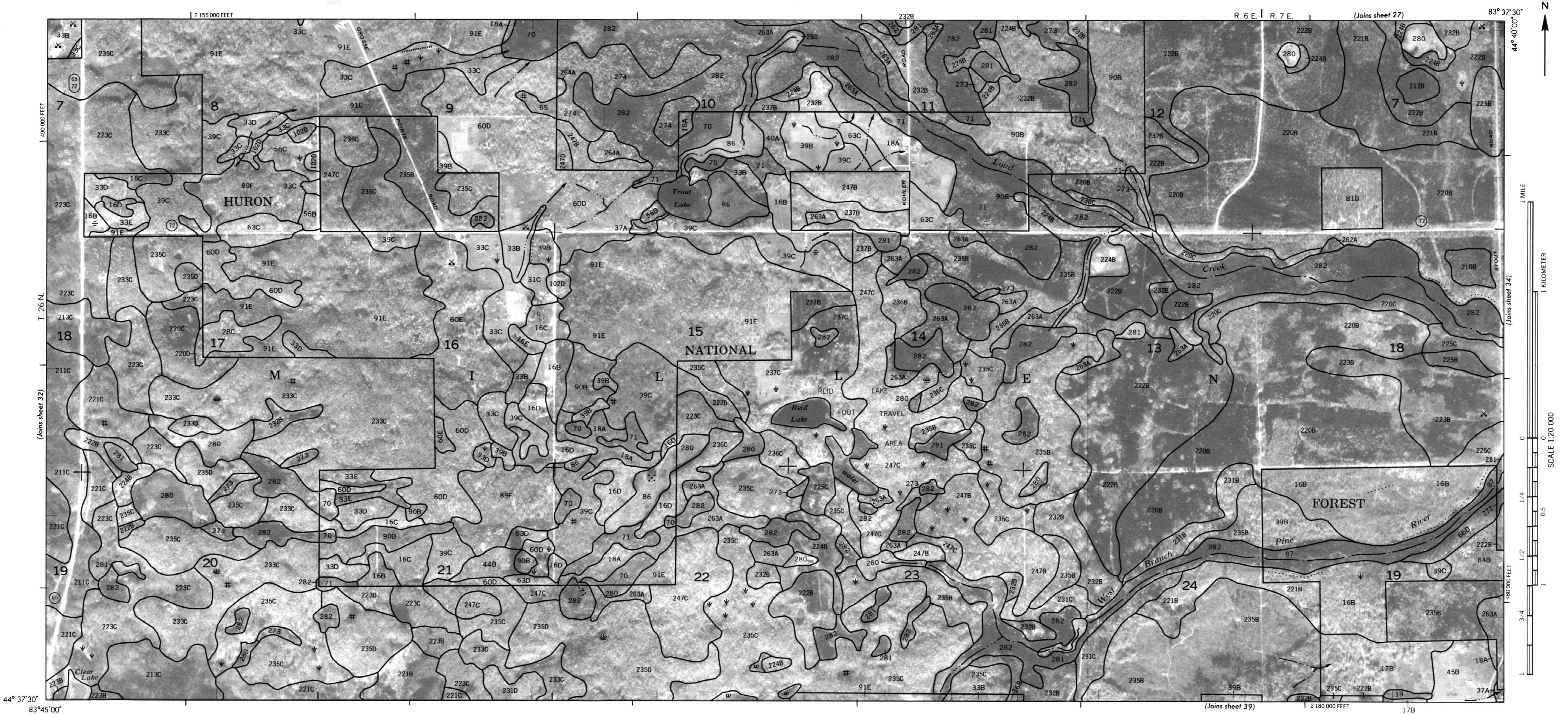
ALCONA COUNTY, MICHIGAN NO. 31



ALCONA COUNTY, MICHIGAN NO. 32

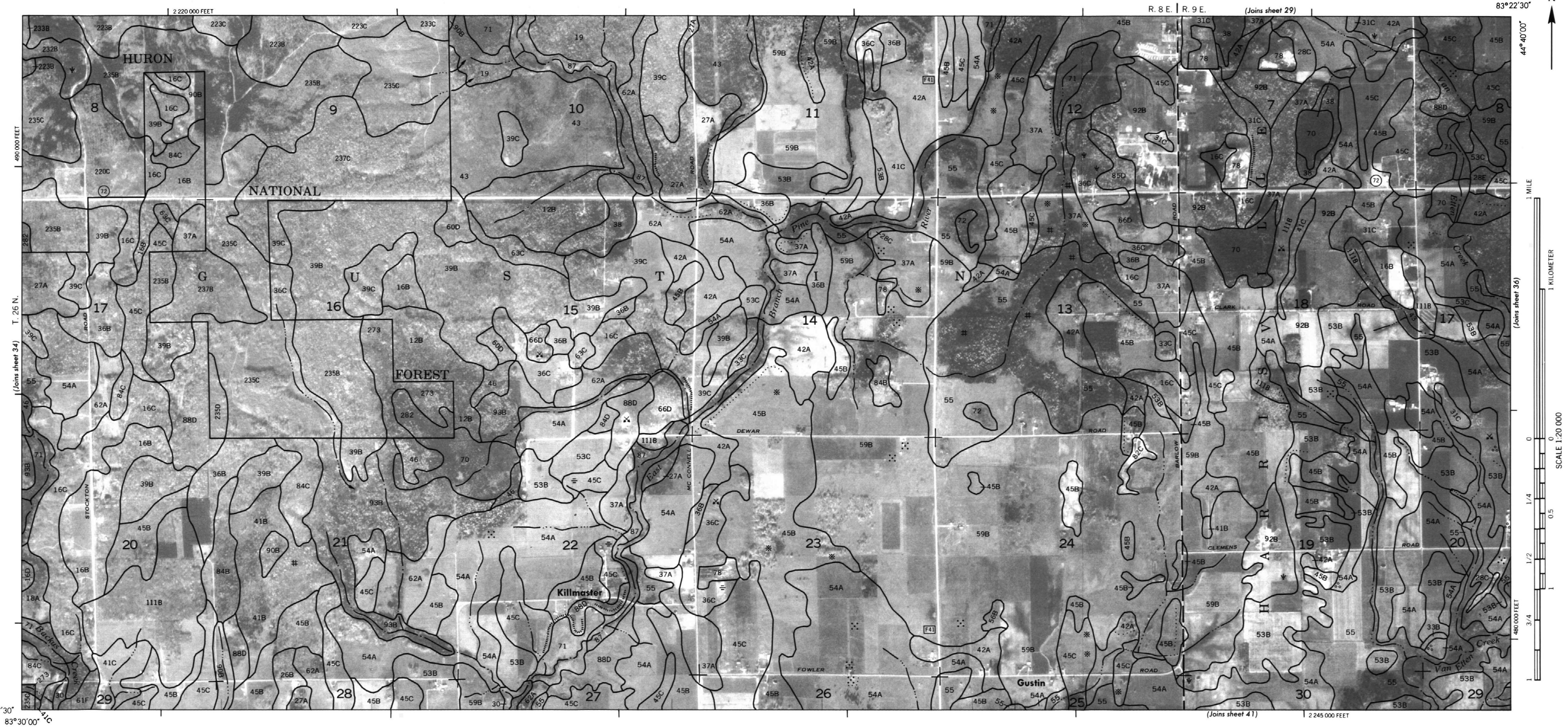
33

ALCONA COUNTY, MICHIGAN NO. 33

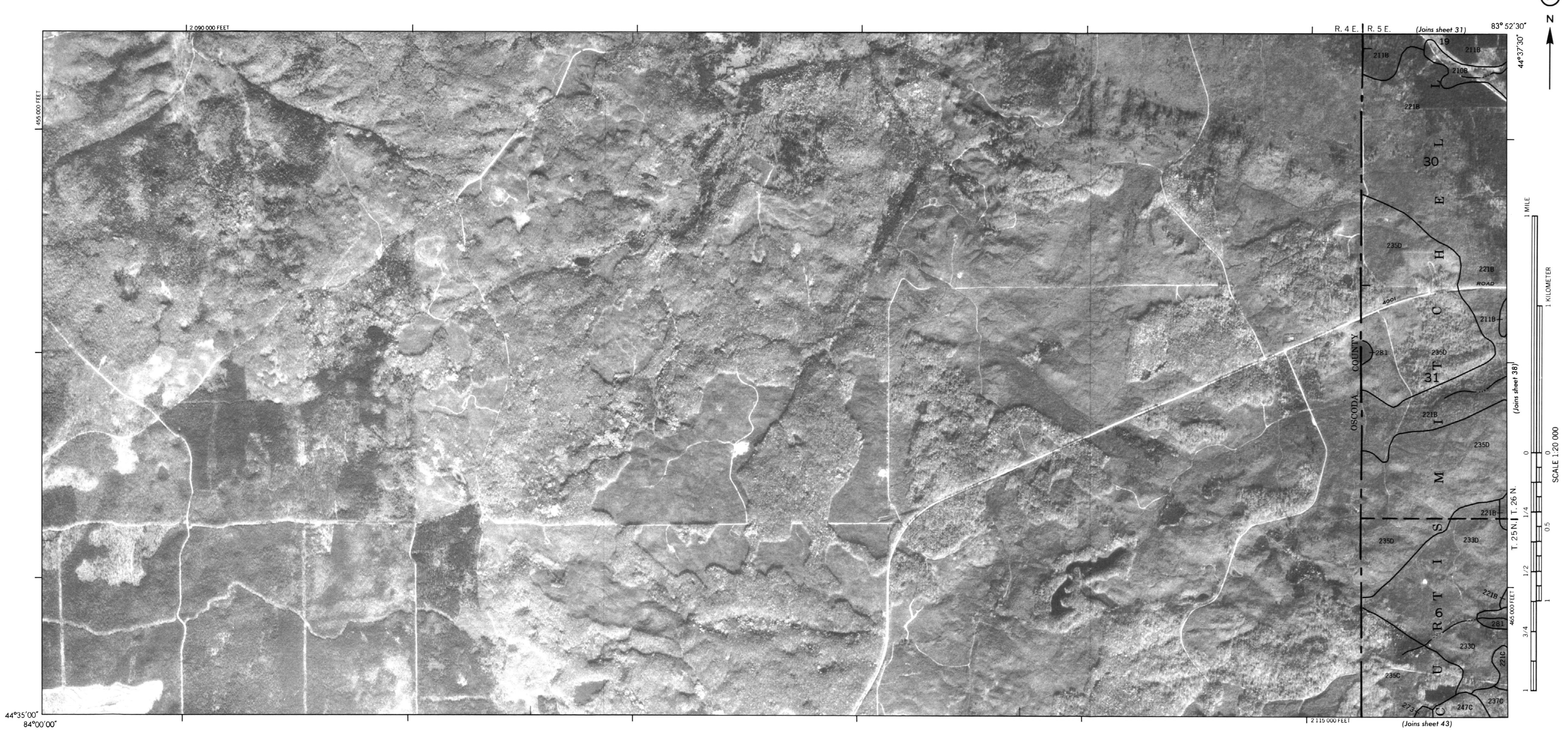


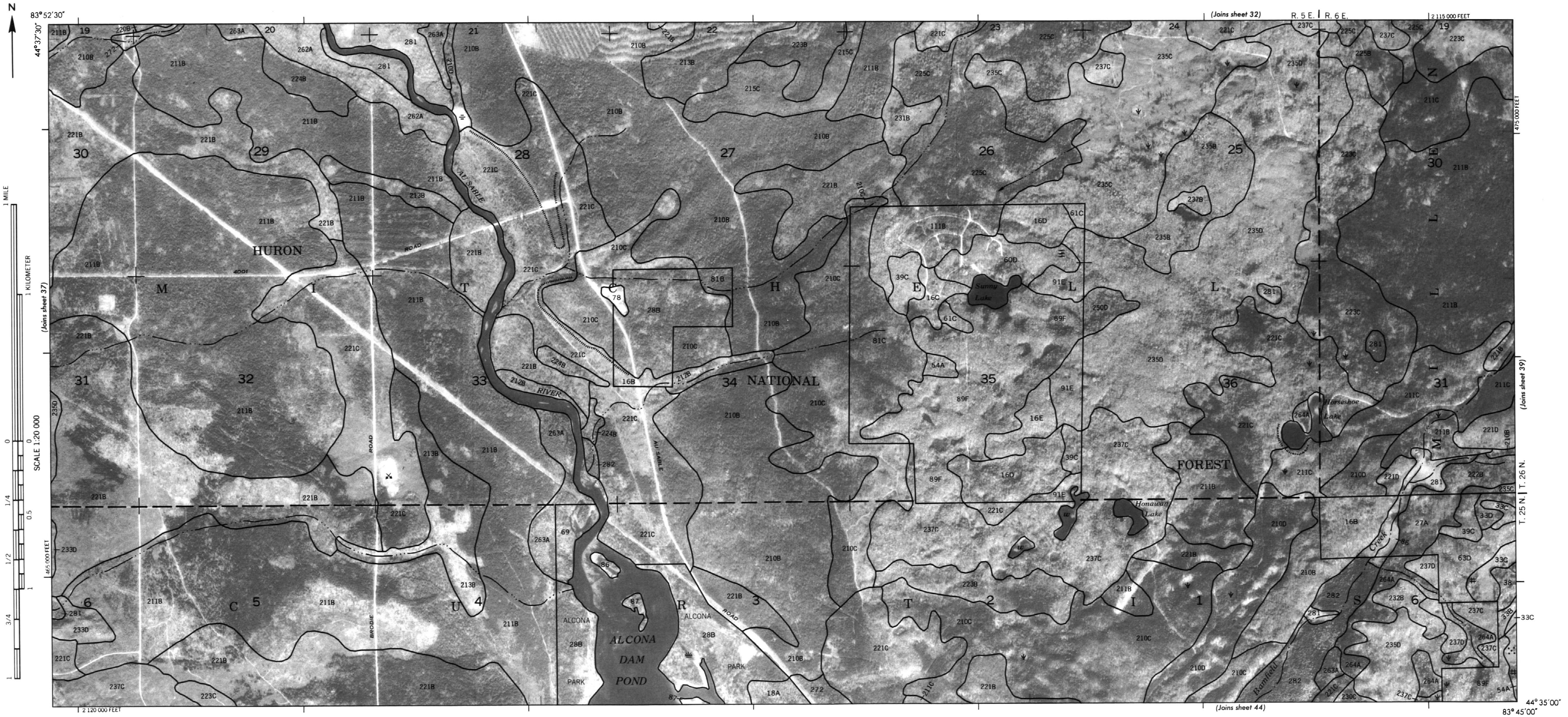

34
N
83°37'30"
44°40'00"
R. 7 E. | R. 8 E.
(Joins sheet 28)
2 215 000 FEET
490 000 FEET
(Joins sheet 33)
(Joins sheet 35)
T. 26 N.
(Joins sheet 40)
2 185 000 FEET
480 000 FEET
44°37'30"
83°30'00"
1 MILE
1 KILOMETER
SCALE 1:20 000
HURON NATIONAL FOREST
Loud Creek
West Branch
Pine River
Backus Creek
HILL ROAD
BEAN
LAKE ROAD
HUBBARD
FOWLER ROAD
ALCONA COUNTY, MICHIGAN NO. 34

35


ALCONA COUNTY, MICHIGAN NO. 35
HURON NATIONAL FOREST
HURON
NATIONAL
FOREST
(Joins sheet 29)
(Joins sheet 34)
(Joins sheet 36)
(Joins sheet 41)
R. 8 E.
R. 9 E.
T. 26 N.
2 220 000 FEET
2 245 000 FEET
490 000 FEET
480 000 FEET
83°22′30″
44°40′00″
44°37′30″
83°30′00″
N
Pine River
Branch
East Branch
Backus Creek
Van Etten Creek
Killmaster
Gustin
DEWAR ROAD
FOWLER ROAD
CLARK ROAD
CLEMENS ROAD
STOCKTON ROAD
MC CONNELL ROAD
BARLOW ROAD
F41
72
1 MILE
1 KILOMETER
SCALE 1:20 000

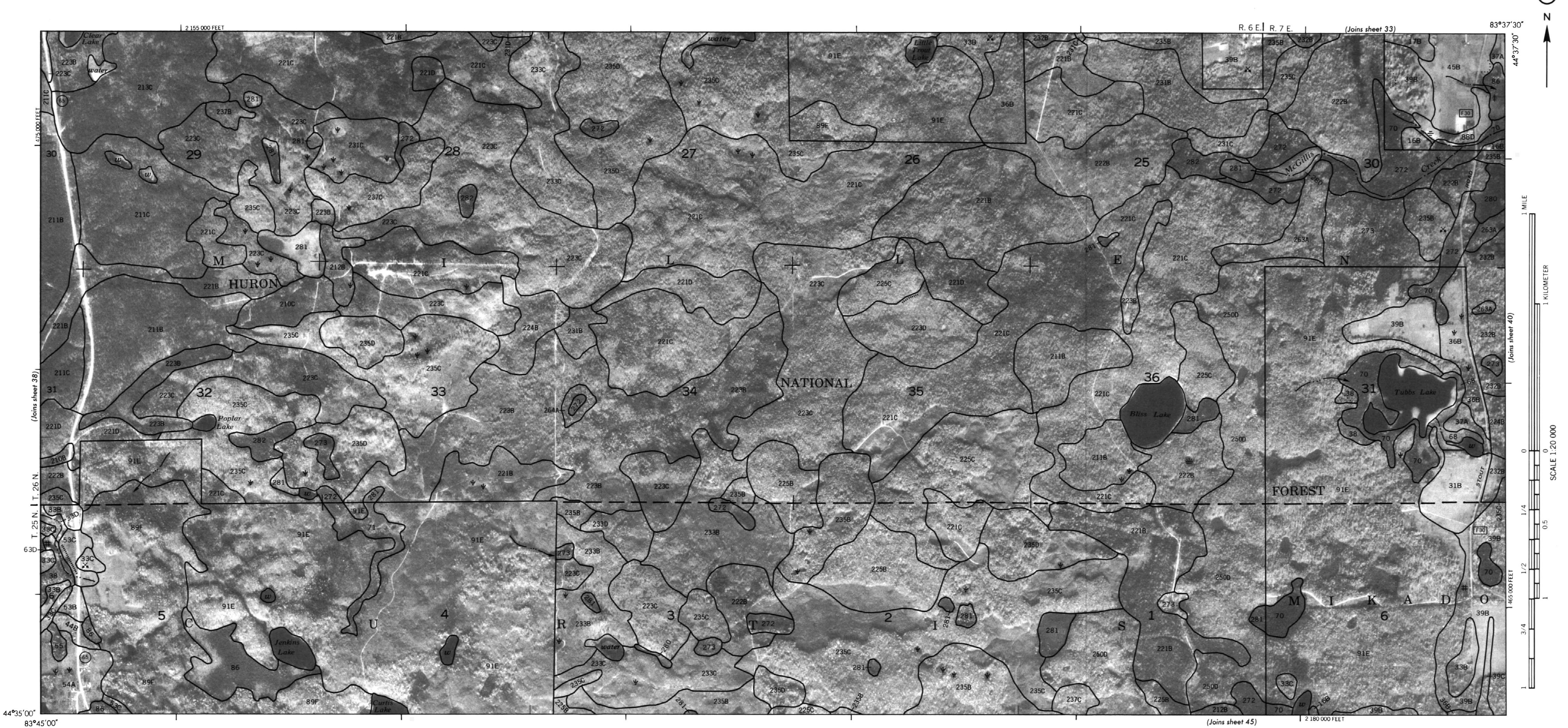

N
83°22'30"
44°40'00"
(Joins sheet 30)
R. 9 E.
2 280 000 FEET
(Joins sheet 35)
T. 26 N.
490 000 FEET
480 000 FEET
2 250 000 FEET
(Joins sheet 42)
44°37'30"
83°15'00"
Harrisville
(county seat)
Springport
HARRISVILLE STATE PARK
SEWAGE LAGOONS
L A K E H U R O N
H A R R I S V I L L E
Mill Creek
Van Etten Creek
1 MILE
1 KILOMETER
SCALE 1:20 000

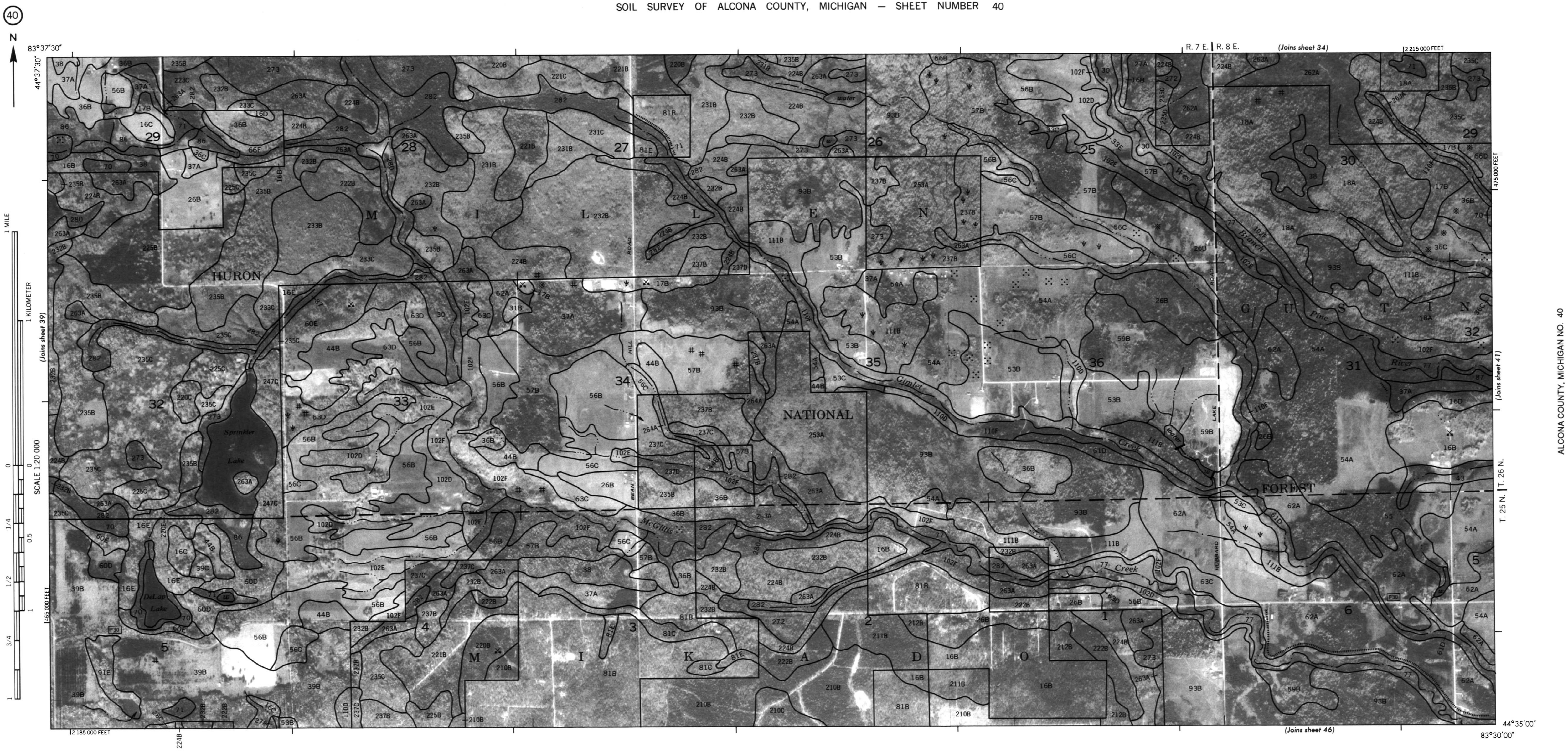

37
N
ALCONA COUNTY, MICHIGAN NO. 37
2 090 000 FEET
455 000 FEET
R. 4 E. | R. 5 E.
(Joins sheet 31)
83° 52′30″
44°37′30″
19
211B
210B
221B
30
235D
ROAD
4001
OSCODA COUNTY
281
31
(Joins sheet 38)
233D
235C
247C
237C
221C
CURTIS
MITCHELL
T. 26 N.
T. 25 N.
465 000 FEET
2 115 000 FEET
(Joins sheet 43)
44°35′00″
84°00′00″
1 MILE
1 KILOMETER
SCALE 1:20 000
0
1/4
1/2
3/4
1
0.5



ALCONA COUNTY, MICHIGAN NO. 38

ALCONA COUNTY, MICHIGAN NO. 39

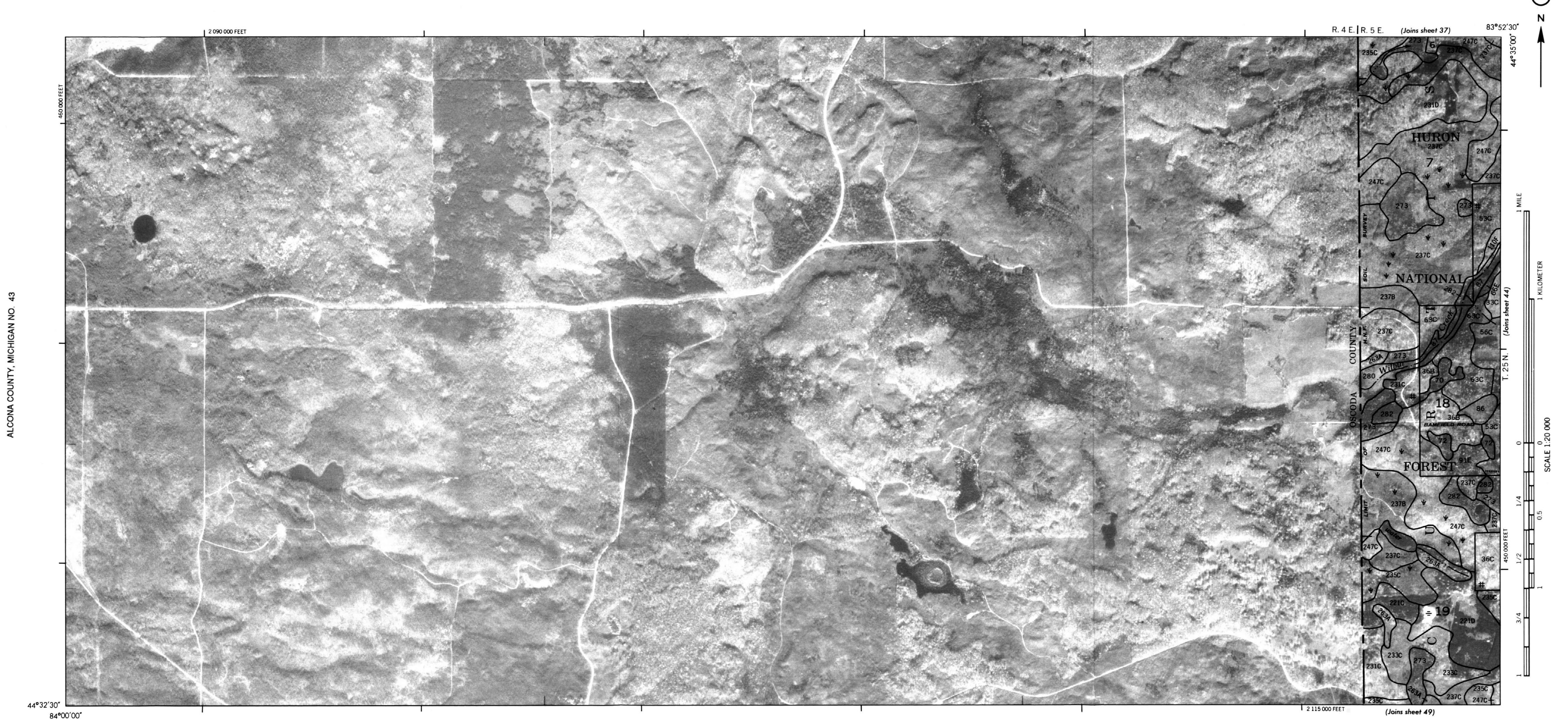


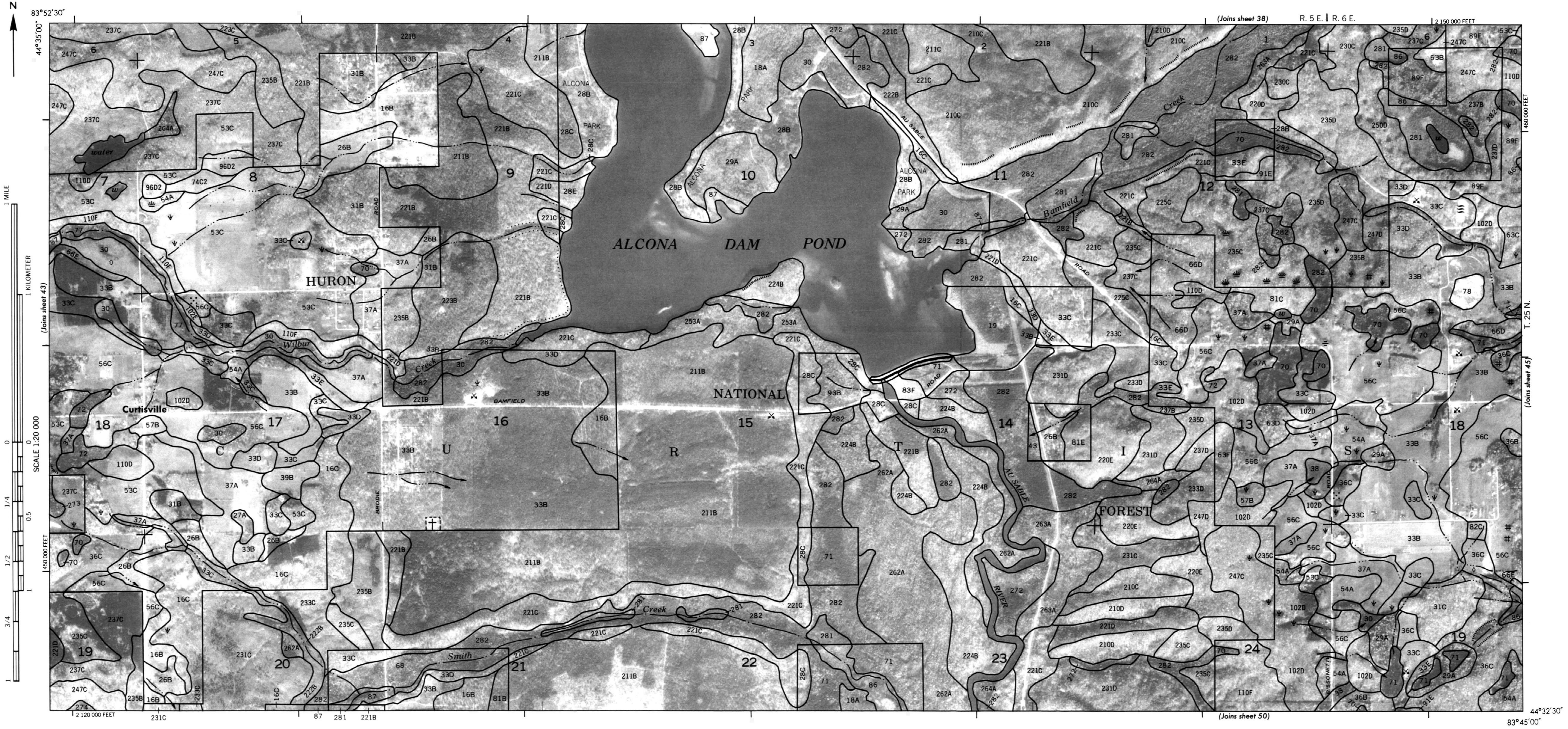

40
N
83°37'30"
44°37'30"
R. 7 E. R. 8 E.
(Joins sheet 34)
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 46)
T. 26 N.
T. 25 N.
44°35'00"
83°30'00"
SCALE 1:20 000
1 MILE
1 KILOMETER
HURON NATIONAL FOREST
Sprinkler Lake
DeLap Lake
Gimlet Creek
McGillis Creek
West Branch Pine River
HILL ROAD
BEAN ROAD
HUBBARD LAKE ROAD

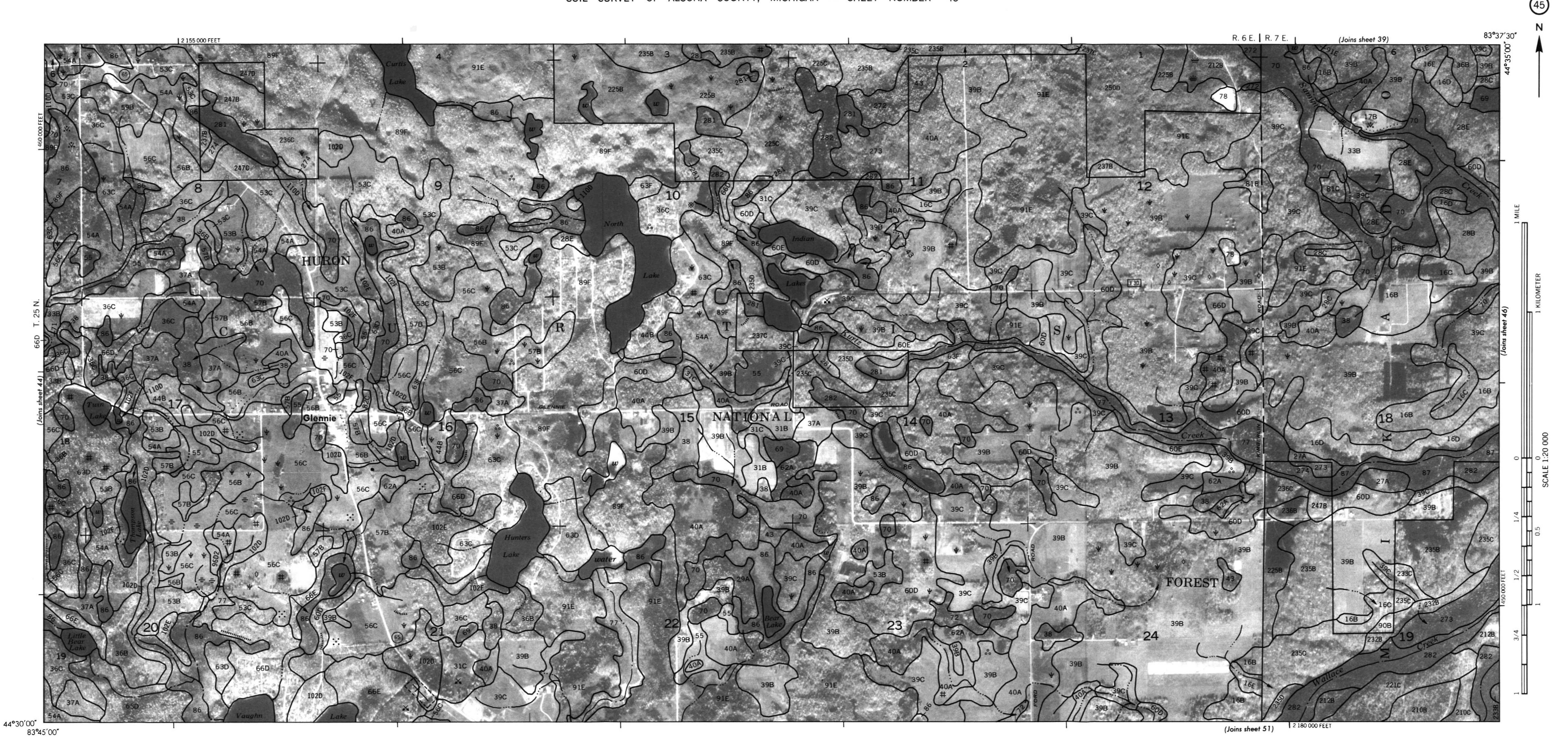

N
83°22'30"
44°37'30"
2 220 000 FEET
R. 8 E. | R. 9 E.
(Joins sheet 35)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 47)
475 000 FEET
465 000 FEET
2 245 000 FEET
T. 26 N.
T. 25 N.
44°35'00"
83°30'00"
PROCUNIER ROAD
MIKADO-GLENNIE ROAD
MIKADO ROAD
CRUZEN ROAD
BARLOW ROAD
Mikado
Backus Creek
West Branch
East Branch
Pine River
Van Etten Creek
G U S T I N
H A R R I S V I L L E
M I K A D O
G R E E N B U S H
1 MILE
1 KILOMETER
SCALE 1:20 000


N
83°22'30"
44°37'30"
(Joins sheet 36)
R. 9 E.
2 280 000 FEET
(Joins sheet 41)
(Joins sheet 48)
2 250 000 FEET
475 000 FEET
465 000 FEET
T. 26 N.
T. 25 N.
44° 35'00"
83°15'00"
1 MILE
1 KILOMETER
SCALE 1:20 000
L A K E H U R O N
H A R R I S V I L L E
G R E E N B U S H
Greenbush
Van Etten Creek
DELLAR ROAD
MIKADO ROAD
RIDLEY ROAD
MC GREGOR
POOR
ALCONA COUNTY, MICHIGAN NO. 42

SOIL SURVEY OF ALCONA COUNTY, MICHIGAN — SHEET NUMBER 43

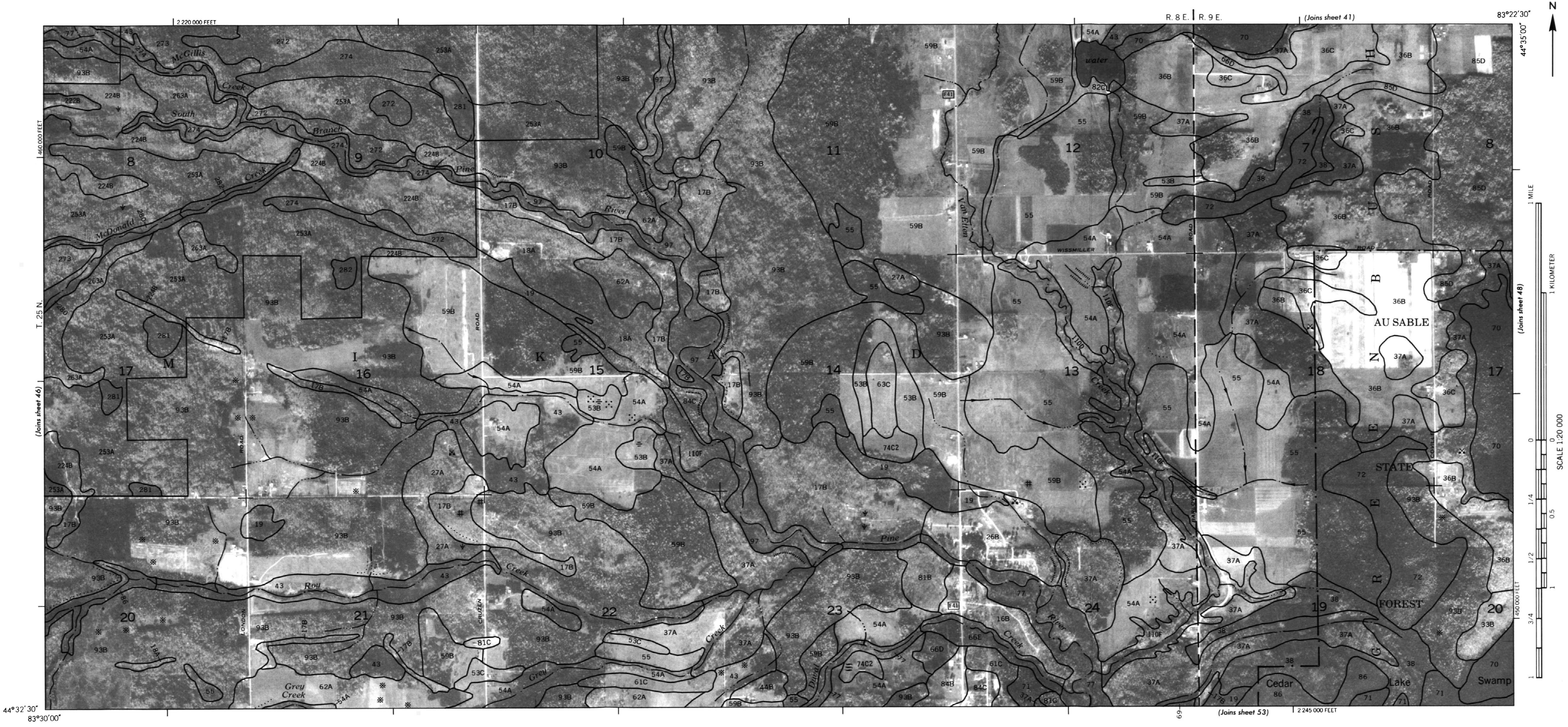



N
83°52'30"
44°35'00"
(Joins sheet 38)
R. 5 E. | R. 6 E.
2 150 000 FEET
460 000 FEET
(Joins sheet 43)
(Joins sheet 45)
T. 25 N.
(Joins sheet 50)
2 120 000 FEET
450 000 FEET
44°32'30"
83°45'00"
1 MILE
1 KILOMETER
SCALE 1:20 000
ALCONA DAM POND
HURON
NATIONAL
FOREST
Curtisville
ALCONA PARK
AU SABLE RIVER
Wilbur Creek
Bamfield Creek
Smith Creek
BAMFIELD ROAD
BRODIE ROAD
BISSONETTE ROAD
water


45
N
ALCONA COUNTY, MICHIGAN NO. 45
(Joins sheet 39)
(Joins sheet 44)
(Joins sheet 46)
(Joins sheet 51)
R. 6 E. | R. 7 E.
T. 25 N.
2 155 000 FEET
2 180 000 FEET
460 000 FEET
450 000 FEET
44°35'00"
83°37'30"
44°30'00"
83°45'00"
HURON NATIONAL FOREST
Glennie
Curtis Lake
North Lake
Indian Lakes
Hunters Lake
Twin Lake
Thompson Lake
Little Bear Lake
Bear Lake
Vaughn Lake
Kurtz Creek
Wallace Creek
Sprinkle Creek
GLENNIE ROAD
1 MILE
1 KILOMETER
SCALE 1:20 000

SOIL SURVEY OF ALCONA COUNTY, MICHIGAN — SHEET NUMBER 46

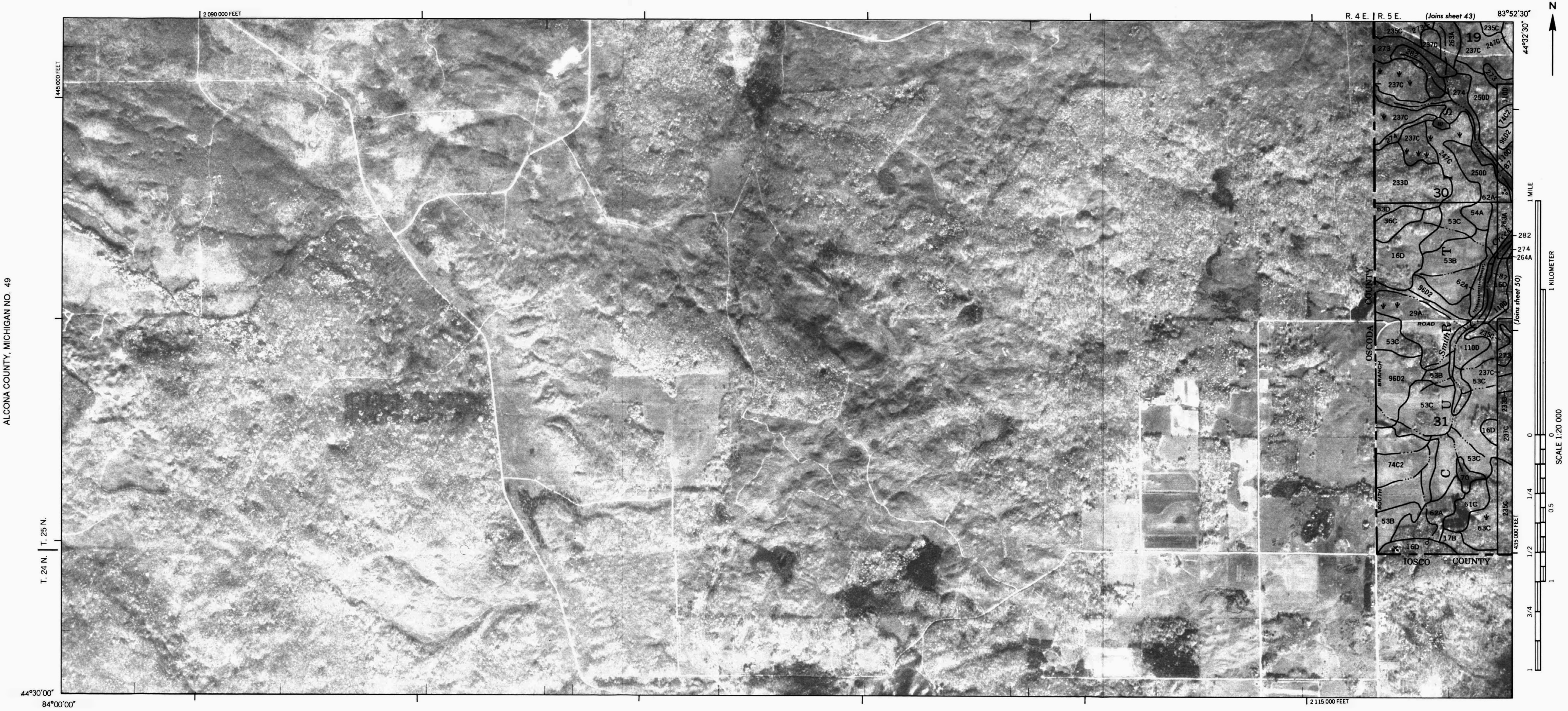
ALCONA COUNTY, MICHIGAN NO. 46



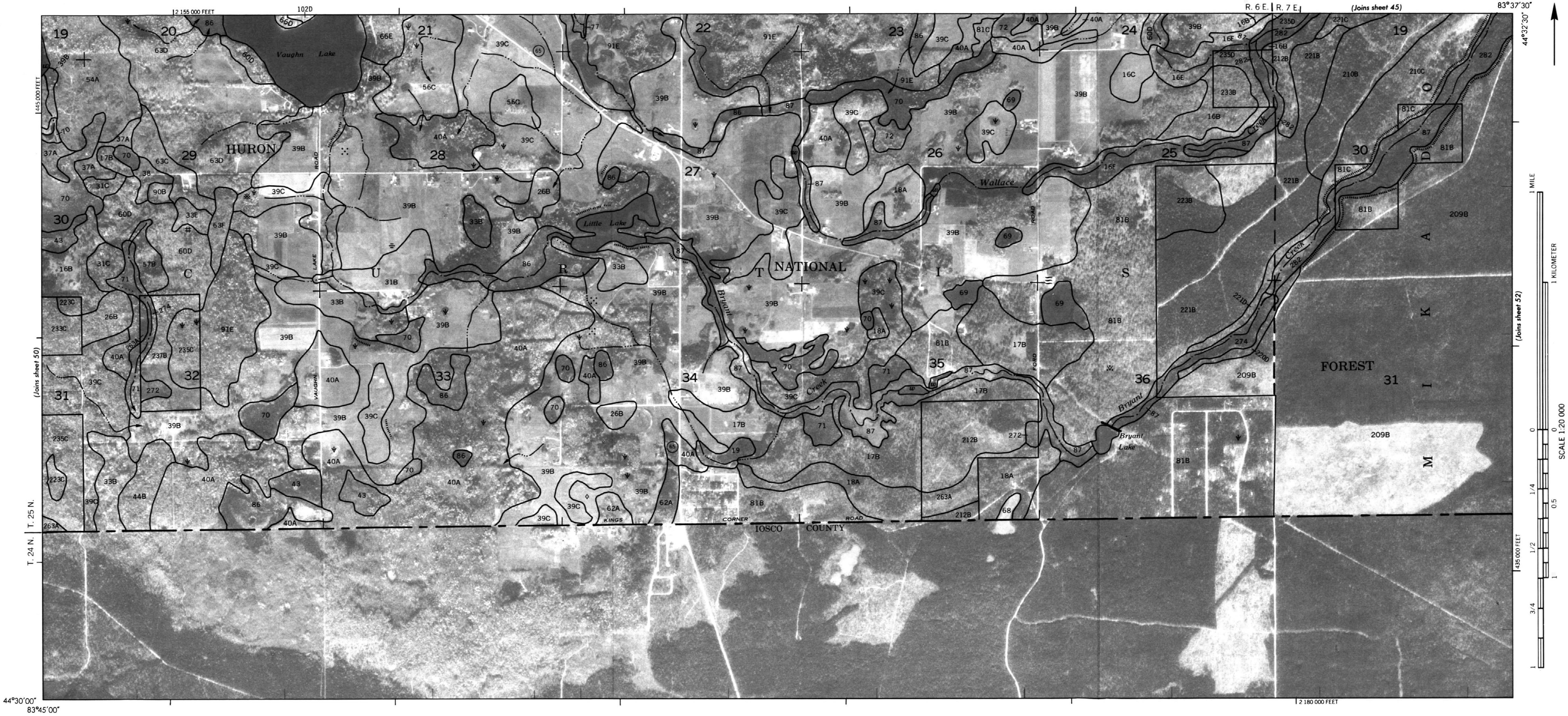
ALCONA COUNTY, MICHIGAN NO. 47


N
83° 22′30″
44°35′00″
(Joins sheet 42)
R. 9 E.
2 280 000 FEET
460 000 FEET
(Joins sheet 47)
T. 25 N.
450 000 FEET
2 250 000 FEET
(Joins sheet 54)
44°32′30″
83°15′00″
1 MILE
1 KILOMETER
SCALE 1:20 000
0
1/4
1/2
3/4
1
0
0.5
1
AU SABLE
STATE
FOREST
G R E E N B U S H
L A K E H U R O N
Swamp
Lake
Cedar
CEDAR
LAKE
WISSMILLER
ROAD
FARM
MACKINAC
POOR
FARM
DETROIT
CEDAR
LAKE
DRIVE
8
9
10
11
14
15
16
17
20
21
22
23
85D
37A
70
71
29A
28B
30
78
86
18A
12B
17B
19
35
63C
84B
84C
94F
40A
26B
68
36B
33B
ALCONA COUNTY, MICHIGAN NO. 48

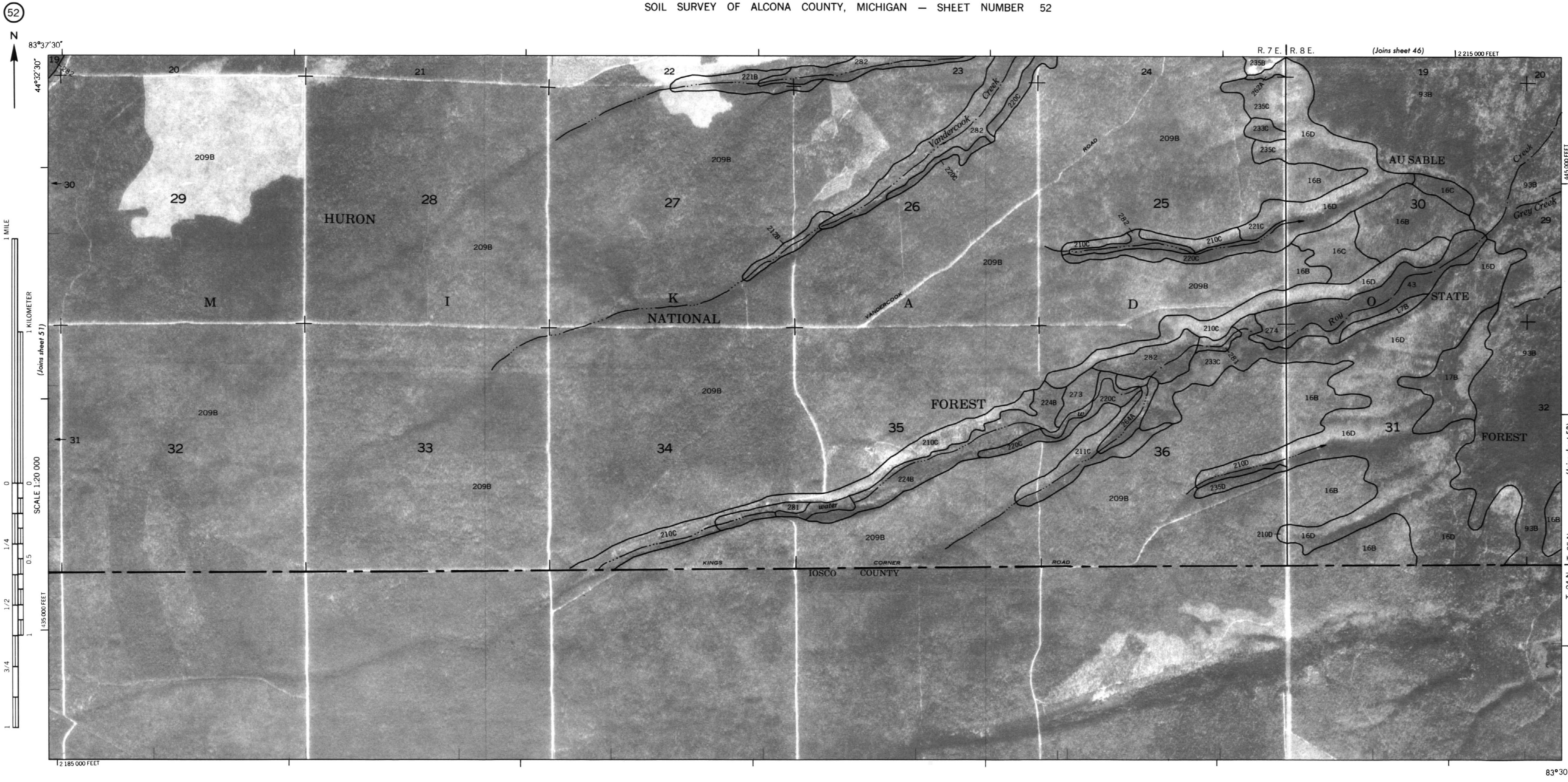
49


2 090 000 FEET
445 000 FEET
R. 4 E.
R. 5 E.
(Joins sheet 43)
83°52′30″
44°32′30″
N
(Joins sheet 50)
OSCODA COUNTY
IOSCO COUNTY
SOUTH BRANCH
ROAD
Smith
Creek
19
30
31
T. 25 N.
T. 24 N.
ALCONA COUNTY, MICHIGAN NO. 49
44°30′00″
84°00′00″
2 115 000 FEET
435 000 FEET
1 MILE
1 KILOMETER
SCALE 1:20 000
0
1/4
1/2
3/4
1
0.5
235C
237C
273
282
263A
274
250D
110D
74C2
96D2
247C
233D
62A
63D
36C
53C
54A
16D
53B
29A
264A
53C
51C
63C
17B
70
233B

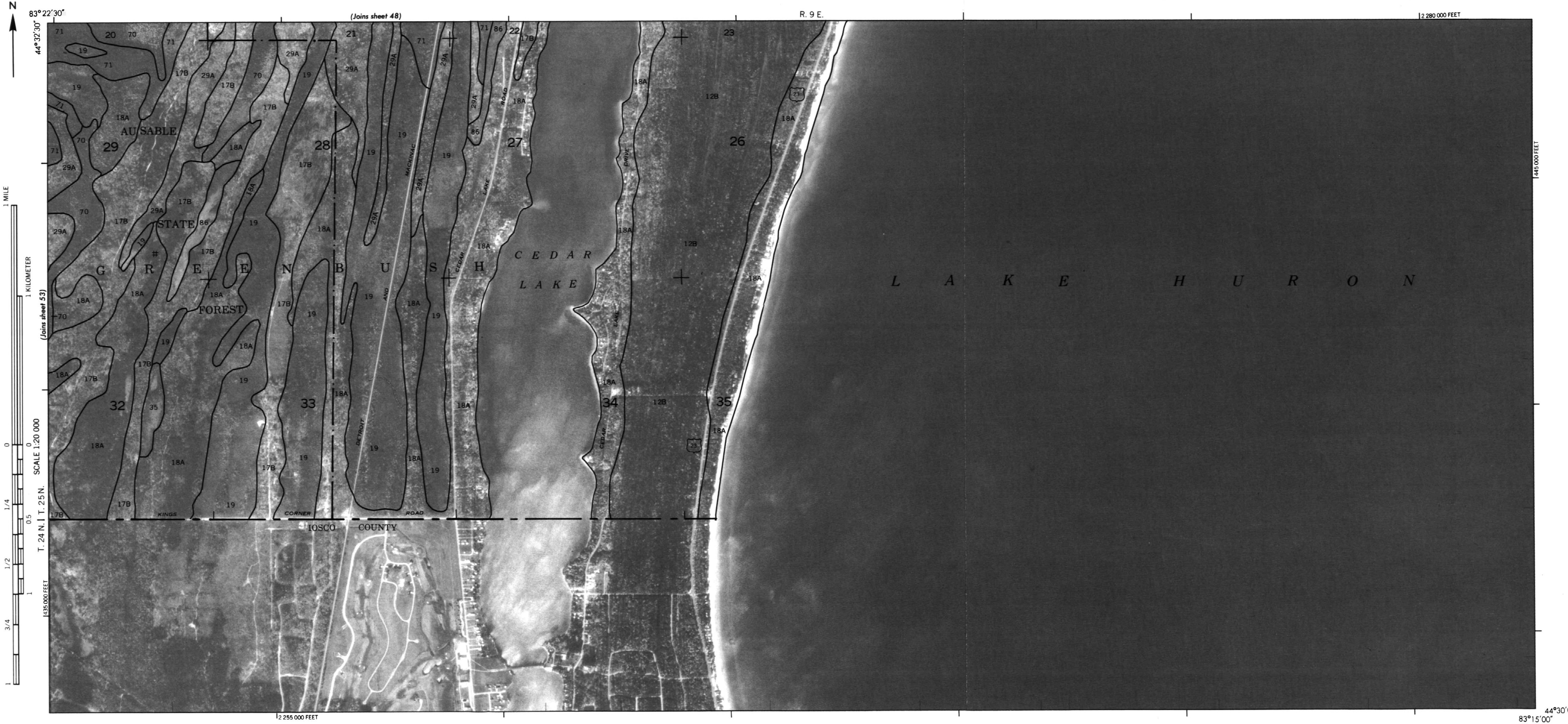

50
N
83°52'30"
44°32'30"
R. 5 E. R. 6 E.
(Joins sheet 44)
2 150 000 FEET
445 000 FEET
(Joins sheet 49)
(Joins sheet 51)
HURON
NATIONAL
FOREST
IOSCO COUNTY
LIMIT OF H.N.F. SOIL SURVEY
LIMIT OF H.N.F. SOIL SURVEY
435 000 FEET
2 120 000 FEET
T. 25 N.
T. 24 N.
44°30'00"
83°45'00"
Smith Creek
AU SABLE RIVER
ALDRICH
BRODIE ROAD
SOUTH BRANCH
BISSONETTE ROAD
1 MILE
1 KILOMETER
SCALE 1:20 000
ALCONA COUNTY, MICHIGAN NO. 50



N
(Joins sheet 45)
(Joins sheet 50)
(Joins sheet 52)
R. 6 E. | R. 7 E.
T. 25 N.
T. 24 N.
83°37'30"
44°32'30"
44°30'00"
83°45'00"
2 155 000 FEET
2 180 000 FEET
445 000 FEET
435 000 FEET
Vaughn Lake
Little Lake
Bryant Lake
Bryant Creek
Wallace Creek
HURON
NATIONAL
FOREST
H U R O N
N A T I O N A L
F O R E S T
VAUGHN LAKE ROAD
FORD ROAD
KINGS CORNER ROAD
IOSCO COUNTY
ALCONA COUNTY, MICHIGAN NO. 51
1 MILE
1 KILOMETER
SCALE 1:20 000


52
N
83°37'30"
44°32'30"
R. 7 E.
R. 8 E.
(Joins sheet 46)
2 215 000 FEET
445 000 FEET
(Joins sheet 51)
(Joins sheet 53)
1 MILE
1 KILOMETER
SCALE 1:20 000
435 000 FEET
2 185 000 FEET
T. 25 N.
T. 24 N.
44°30'00"
83°30'00"
HURON
M
I
K
NATIONAL
A
D
FOREST
AU SABLE
O
STATE
FOREST
Vandercook
Creek
ROAD
VANDERCOOK
Roy
Grey Creek
Creek
water
KINGS
CORNER
ROAD
IOSCO
COUNTY
209B
16B
16C
16D
93B
17B
43
210C
210D
220C
221B
221C
224B
233C
235B
235C
235D
262A
264A
273
274
281
282
211C
212B


ALCONA COUNTY, MICHIGAN NO. 53
(Joins sheet 47)
(Joins sheet 52)
(Joins sheet 54)
R. 8 E. | R. 9 E.
T. 25 N.
T. 24 N.
83°22'30"
44°32'30"
44°30'00"
83°30'00"
2 220 000 FEET
445 000 FEET
435 000 FEET
2 250 000 FEET
AU SABLE STATE FOREST
MIKADO
AU SABLE STATE FOREST
Cedar Lake Swamp
IOSCO COUNTY
GODDARD ROAD
LONDON ROAD
ALVIN ROAD
KINGS CORNER ROAD
BARLOW ROAD
Grey Creek
Roy Creek
Duval
Hill Creek
Pine River
water
SCALE 1:20 000
1 MILE
1 KILOMETER
N


N
83°22′30″
44°32′30″
(Joins sheet 48)
R. 9 E.
2 280 000 FEET
(Joins sheet 53)
AU SABLE
STATE
FOREST
G R E E N B U S H
CEDAR LAKE
L A K E H U R O N
IOSCO COUNTY
KINGS CORNER ROAD
MACKINAC
DETROIT AND MACKINAC
CEDAR LAKE ROAD
CEDAR LAKE DRIVE
T. 25 N.
T. 24 N.
445 000 FEET
435 000 FEET
2 255 000 FEET
44°30′00″
83°15′00″
1 MILE
1 KILOMETER
SCALE 1:20 000