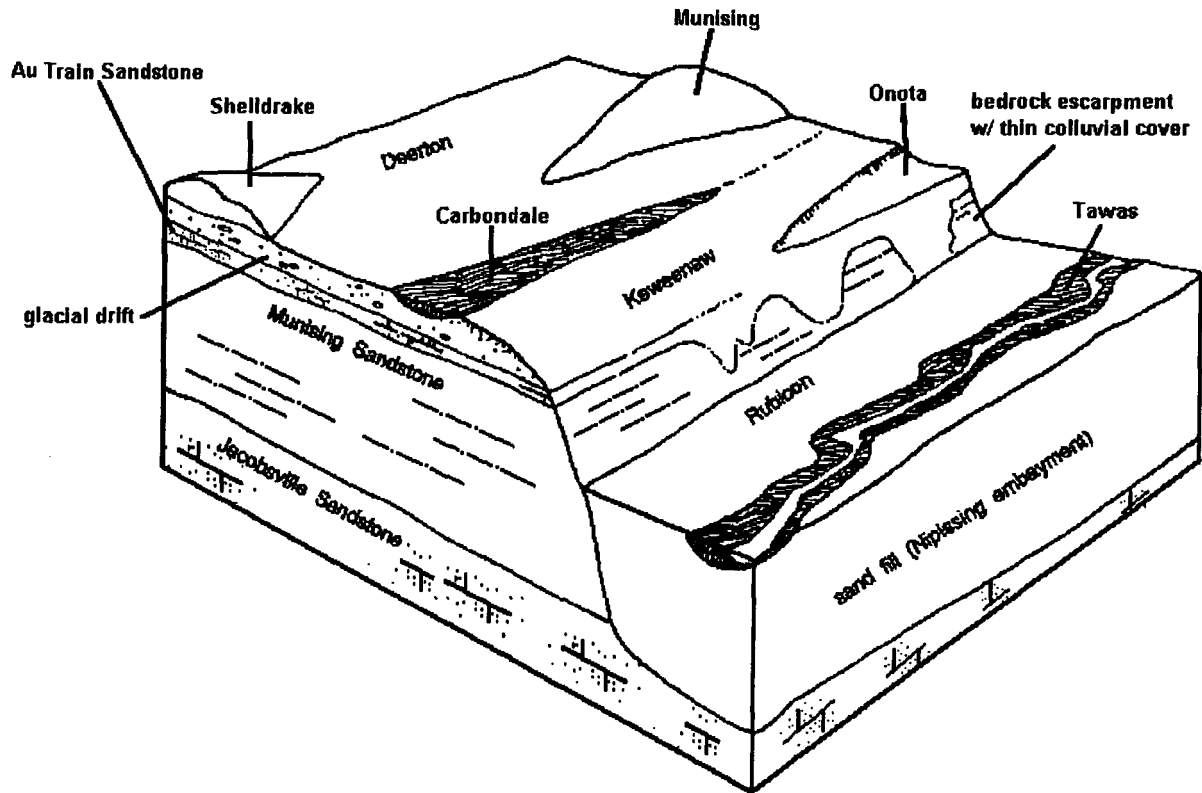


Soil Survey of Pictured Rocks National Lakeshore



United States Department of Agriculture



Soil Conservation Service



United States Department of Interior

National Park Service

In cooperation with United States Department of Agriculture, Forest Service; Michigan Department of Agriculture; Michigan Agriculture Experiment Station; Michigan Technological University

1993

This soil survey is a publication of the Soil Conservation Service, a joint effort of the United States Department of Agriculture and United States Department of Interior, National Park Service. Funding for this survey was provided by the Pictured Rocks National Lakeshore. The Soil Conservation Service provided technical expertise and leadership for the Soil Survey of Pictured Rocks National Lakeshore. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in October of 1992. Map finishing and publication was completed in 1993. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. This survey is being published as an interim report and is subject to revision. It will be superseded by the Soil Survey of Alger County Area report upon its completion. It is part of the technical assistance furnished to the U.S.D.I. National Park Service by the Soil Conservation Service.

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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Ad--Alluvial land.....	11	RuE--Rubicon sand, 18 to 40 percent slopes.....	60
AsA--Assinins sand, 0 to 3 percent slopes.....	12	ShB--Shelldrake sand, 0 to 8 percent slopes.....	60
AuB--Au Gres sand, 0 to 6 percent slopes.....	13	SkB--Skaneesee sandy loam, 0 to 6 percent slopes.....	61
BIB--Blue Lake sand, 0 to 6 percent slopes.....	14	StB--Steuben sandy loam, 0 to 6 percent slopes.....	62
BID--Blue Lake sand, 6 to 18 percent slopes.....	14	StD--Steuben sandy loam, 6 to 18 percent slopes.....	63
BIE--Blue Lake sand, 18 to 40 percent slopes.....	15	SvA--Sundell fine sandy loam, 0 to 4 percent slopes.....	63
BoB--Bohemian fine sandy loam, 0 to 6 percent slopes.....	16	SwA--Sundell loamy fine sand, sandy variant, 0 to 4 percent slopes.....	64
BoD--Bohemian fine sandy loam, 6 to 18 percent slopes.....	16	Ta--Tawas muck.....	65
Bp--Borrow pits.....	17	TrB--Trenary fine sandy loam, 2 to 6 percent slopes.....	66
Bs--Brevort mucky loamy sand.....	18	TrD--Trenary fine sandy loam, 12 to 18 percent slopes.....	66
BtA--Brimley fine sandy loam, 0 to 4 percent slopes.....	18	WaA--Wainola fine sand, 0 to 4 percent slopes.....	67
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BwC--Burt mucky sandy loam, 2 to 12 percent slopes.....	20	YaD--Yalmer sand, 6 to 18 percent slopes.....	68
Cb--Carbondale, Lupton and Rifle soils.....	20		
Ck--Cathro and Tacoosh mucks.....	21		
CmD--Chatham fine sandy loam, 6 to 18 percent slopes.....	22		
Cn--Chippeny muck.....	23		
CrA--Croswell sand, 0 to 4 percent slopes.....	24		
Dd--Dawson and Greenwood peats.....	24		
DeB--Deerton sand, 0 to 6 percent slopes.....	25		
DeD--Deerton sand, 6 to 18 percent slopes.....	26		
DIB--Deerton-Burt complex, 0 to 6 percent slopes.....	27		
Dn--Duneland, moderately sloping to steep.....	28		
DnG--Duneland, very steep.....	28		
EcB--Adams loamy sand, 0 to 6 percent slopes.....	29		
EcD--Adams loamy sand, 6 to 18 percent slopes.....	30		
EkB--Adams-Kalkaska complex, 0 to 6 percent slopes.....	31		
EkD--Adams-Kalkaska complex, 6 to 18 percent slopes.....	31		
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Es--Ensley and Angelica soils.....	33		
Gw--Greenwood peat.....	34		
HaB--Halfaday sand, 0 to 4 percent slopes.....	35		
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Jb--Jacobsville-Burt complex.....	36		
KaB--Kalkaska sand, 0 to 6 percent slopes.....	37		
KaD--Kalkaska sand, 6 to 18 percent slopes.....	38		
KaE--Kalkaska sand, 18 to 40 percent slopes.....	39		
KaG--Kalkaska sand, 40 to 80 percent slopes.....	40		
KdB--Karlin sandy loam, 0 to 6 percent slopes.....	40		
KdD--Karlin sandy loam, 6 to 18 percent slopes.....	41		
KdE--Karlin sandy loam, 18 to 40 percent slopes.....	42		
KgC--Kawbawgam sandy loam, 0 to 10 percent slopes.....	42		
KmB--Kalkaska-Munising complex, dissected, 1 to 12 percent slopes.....	43		
KmD--Kalkaska-Munising complex, dissected, 8 to 35 percent slopes.....	44		
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KnB--Keweenaw loamy sand, 0 to 6 percent slopes.....	46		
KnD--Keweenaw loamy sand, 6 to 18 percent slopes.....	47		
Kr--Kinross mucky sand.....	48		
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McB--Mancelona loamy sand, 0 to 6 percent slopes.....	49		
Mh--Marsh.....	49		
MuB--Munising sandy loam, 0 to 6 percent slopes.....	50		
MuD--Munising sandy loam, 6 to 18 percent slopes.....	51		
MuE--Munising sandy loam, 18 to 40 percent slopes.....	51		
Nh--Nahma muck.....	52		
OoE--Onota-Chippeny complex, 0 to 35 percent slopes.....	53		
OrB--Onota-Deerton complex, 0 to 6 percent slopes.....	54		
OrD--Onota-Deerton complex, 6 to 18 percent slopes.....	55		
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Rc--Roscommon mucky sand.....	57		
RkB--Roscommon-Kalkaska complex, 0 to 6 percent slopes.....	57		
RuB--Rubicon sand, 0 to 6 percent slopes.....	58		
RuD--Rubicon sand, 6 to 18 percent slopes.....	59		

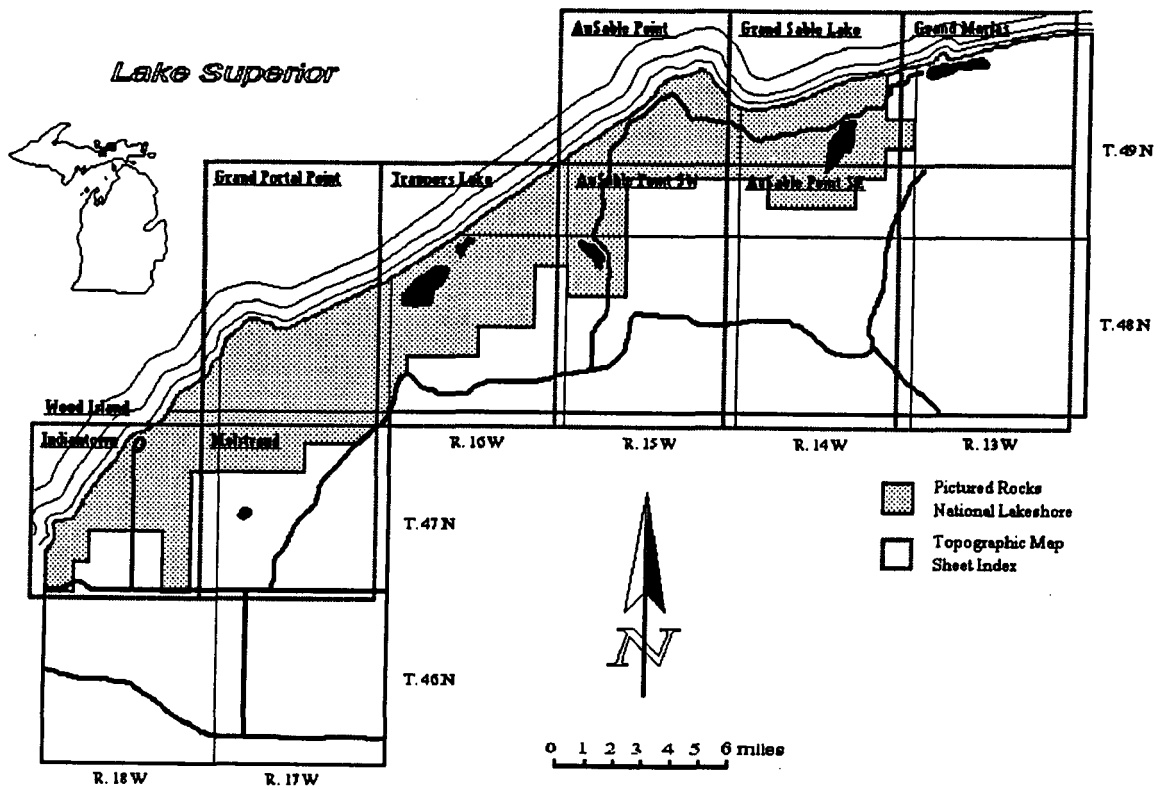


Figure 1 - Location of Pictured Rocks National Lakeshore in Alger County, Michigan

Soil Survey of Pictured Rocks National Lakeshore

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United States Department of Agriculture, Soil Conservation Service
In cooperation with

United States Department of Interior, National Park Service, Michigan Department of Agriculture, Michigan Agricultural Experiment Station and Michigan Technological University

Introduction

PICTURED ROCKS NATIONAL LAKESHORE (PRNL) is located in Alger County, Michigan, in the north central part of the Upper Peninsula. It stretches along the shore of Lake Superior for a distance of 38 miles between the towns of Munising and Grand Marais (see Figure 1). The survey area consists of the entire area of 71,397 acres within the National Lakeshore boundary, which is divided into a shoreline zone of 33,548 acres and an inland buffer zone of 37,849 acres. Soil mapping was completed in the entire shoreline zone (the area owned entirely "in fee" by the US government) and on 19,825 acres within the inland buffer zone for a total area of 53,373 acres included in this publication. The "Fee Zone" boundary and National Lakeshore boundary are shown on all of the soil maps. The limit of soil mapping within the inland buffer zone, where it doesn't coincide with the National Lakeshore boundary, is labeled "Limit Of Soil Survey". The appearance of these boundaries is identified on the Conventional and Special Symbols Legend.

This publication is a combination of all known soil mapping conducted within the boundary of the PRNL prior to 1993. The manuscript and tables conform to modern

National Cooperative Soil Survey (NCSS) standards and the soil maps were recompiled onto 1/3 7.5 minute topoquad atlas sheets with a nominal scale of 1:24000. The photobase for the atlas sheets was National High Altitude Program (NHAP) imagery dated May 17 and 18, 1981.

The color Progress Map located immediately before the soil maps shows the areal extent of contributions made to this project by the two previous soil survey publications and more recent mapping contracted by the National Park Service.

The area in yellow includes that portion of the National Lakeshore that lies west of the Range 17 West and Range 18 West rangeline. This area was recompiled from the "Soil Survey of Delta County and Hiawatha National Forest of Alger and Schoolcraft Counties, Michigan". The field work for this area was completed in the late 1960's, and the NCSS publication was released in November of 1977. The area in yellow totals 11006 acres or 21% of the survey area. No recorrelation of this area was made, but some minor shifting of the soil boundaries was necessary during the transfer to new atlas sheets. The soil legend and typical pedons from the Delta-Hiawatha soil survey were used for the Soil Survey of Pictured Rocks National Lakeshore, with the exception of those new soils and map units encountered in later mapping.

The area in red on the Progress Map was included in the "Soil Resource Inventory of Pictured Rocks National Lakeshore" which was published in September of 1985 by Randy L. Davis of the Hiawatha National Forest under contract with the National Park Service. A total of 16684 acres, or 31% of the survey area are in the red colored area. Small portions of the 1985 Soil Resource Inventory were remapped in order to facilitate joining with subsequent mapping.

The area in blue on the Progress Map was mapped by Loren Berndt of the Soil Conservation Service (SCS) in 1972, and covers 4553 acres or 8% of the survey area. The original field sheets are on file at the Marquette field office of the SCS. Some minor changes were made to the soil boundaries during the recompilation to new atlas sheets and the map unit symbols were correlated to coincide with the rest of the survey area.

The area in green on the Progress Map was mapped by the author, Lawrence M. Carey, of the SCS. The mapping was performed under contract to the National Park Service during 1987, 1988 and 1992. The area in green covers 21130 acres or 40% of the survey area.

In addition to soil mapping, the author performed all map compilation and finishing for this soil survey. The manuscript was also written by Lawrence M. Carey, with the following exceptions: Walter Loope, Ecologist with PRNL wrote the Geology and Geomorphology section and produced the block diagrams shown in that section (Figures 2,3 and 4), as well as the section on Climate. Dr. Loope also provided the vision and secured funding for all of the contracts required to conduct this soil survey, and worked closely with the author to coordinate the completion of the Soil Survey of Pictured Rocks National Lakeshore. The Michigan State Office of the SCS assisted in acquiring the map finishing materials, reviewed the manuscript and produced the interpretive tables for this publication. The Marquette Area Office of the SCS also provided PRNL with a digital copy of this soil survey under separate contract.

The soils of PRNL are quite variable, with 51 soil types and 76 map units

occurring in the area covered by this publication. It combines all the previous soil inventories into one book with a uniform soil legend, scale and updated interpretations. The user of this soil survey should keep in mind that the mapping in the red, blue and green areas of the Progress Map has not been formally correlated and is subject to change when it is incorporated into the published soil survey of the Alger county area. Nonetheless, the Soil Survey of Pictured Rocks National Lakeshore will serve as a valuable guide to the composition, use and management of the National Lakeshore's soil resources for years to come.

Climate

Lake Superior, which forms the park's northern edge, has a strong influence on its climate throughout the year. The most evident effects of the lake are the increased cloudiness and moderation of temperature extremes during cold air outbreaks in the fall and early winter. As ice builds on the lake, these effects are greatly reduced. In the summer months, cooler temperatures are associated with development of northerly lake breezes. Thus the park's climate alternates between semi-marine and continental in character (8).

Because day-to-day weather at this latitude is controlled largely by the movement of pressure systems across the nation, Munising seldom experiences prolonged periods of either hot, humid weather in summer or extreme cold during the winter. The prevailing wind at the nearest station is west averaging 9 MPH. Average 1 PM relative humidity varies from 61% in April to 70% in November and December. Percent of possible sunshine varies from 67% in July to 27% in November and December and averages 50%.

Summers are dominated by pleasantly warm temperatures with an average of only six days exceeding 90 degrees F. On an average, from November through March, 19 days will reach 0 degrees F. These colder temperatures, more commonly experienced inland, usually occur when skies clear and

winds diminish. Under these conditions, the influence of Lake Superior is minimized.

Precipitation, averaging 34 inches annually, is spread more or less evenly throughout the year. 58% of the total precipitation is received during the May through October growing season. June and September are the wettest months and March, the driest. Summer precipitation is usually in the form of afternoon showers or thundershowers. On the average, thunderstorms occur on 26 days. Pan evaporation during the growing season in the park area averages 25 inches. As a result, periods of low soil moisture are not uncommon, despite the "maritime" location of the park.

Average snowfall is around 150 inches; average annual duration of snow cover (>1 inch) is 145 days. The growing season averages 94 days (18).

Geology and Geomorphology

Geological history recorded in the sedimentary rocks and surficial deposits of PRNL is limited to two widely separated intervals of geologic time, the Cambrian, and early Ordovician Periods (500-600 million years before present) and the late Quaternary Period (2 million years before present to the present). During the Cambrian and early Ordovician periods, sediments were deposited in the shallow seas and near-shore deltas that covered what is now northern Michigan. These deposits became the sandstone units that are exposed within PRNL. Except for their exposure near Lake Superior, these units are presently covered by a veneer of Quaternary glacial drift.

Bedrock Geology

Bedrock is best observed in the western one-third of PRNL where cliffs rise up to 180 feet from Lake Superior. These extend along the lake about 17 miles from Munising to Beaver Basin. For a short distance inland from the escarpment, bedrock is occasionally exposed.

The sandstones of the park are derived from fluvial, lacustrine and shallow marine deposits of quartz sand that were shed northward off a regional range of mountains, the "Northern Michigan Highland" and southward from highlands in adjacent parts of "Canada" (12). The Highland was probably similar in lithology to present-day outcroppings of pre-Cambrian rocks west of PRNL.

The Jacobsville Formation, of late Precambrian age (700-800 million years old), is the oldest formation exposed in the park. It is a fluvial/lacustrine, feldspar-rich quartz sandstone, deep red in color with white mottling. The red coloration is thought to be primary and the white, a result of subsequent leaching along joints and bedding planes (12). The Jacobsville, regionally quite variable in thickness, is 1,100 feet thick in the Grand Marais area; usually only the top few feet rise above lake level within PRNL (e.g. vicinity of Au Sable Point). This formation was quarried for building stone in the late nineteenth century. Several buildings in Munising and Marquette were constructed using Jacobsville block or facing. The western side of Grand Island, just west of PRNL within the Hiawatha National Forest, features spectacular Jacobsville cliffs.

The Late Cambrian (500-520 million years old), light gray to white Munising Formation lies unconformably above the Jacobsville. The unconformity represents a time lapse of several million years; Jacobsville rock was deformed and eroded prior to the advance of the Munising sea. The Munising Formation probably represents a complex shoreline/ shallow water environment that was influenced by fluvial, wave, tidal and eolian processes (11). The Munising is divided into three members: the basal conglomerate, the Chapel Rock sandstone and Miners Castle sandstone.

The basal conglomerate unit is 2 to 15 feet thick. Its fluviually deposited pebbles and cobbles are comprised of vein quartz, quartzite, and chert with lesser amounts of slate, basalt, granite, iron formation, and sandstone. Some of the clasts are derived from the underlying Jacobsville.

Above the basal conglomerate lies the 40 to 60 foot thickness of the Chapel

Rock Member. This member is pinkish gray or light buff to brown, medium grained, orthoquartzitic sandstone. The large scale cross-bedding of this unit can be observed at its type locality, Chapel Rock; east of the mouth of the Mosquito River, it comprises virtually the entire section exposed in the Pictured Rocks (12). A few thin, dark gray, clayey mudstones are scattered throughout the Chapel Rock Member. This member displays several other striking sedimentary structures including mud cracks, ripple marks, animal trackways, clay pellets and clastic dikes. Some of these features can be seen in exposures near the mouth of the Mosquito River (11).

The contact between the Chapel Rock Member and the overlying Miners Castle Member is easily identified by changes in color (related to mineralogical composition), in type of cross-bedding (large scale vs. small scale) and in geomorphic expression of the rock units. The resistant, light pinkish gray Chapel Rock Member has large dimension cross beds and forms steep cliffs and rock benches; the crumbly, multihued (red, yellow, green, blue) and gray Miners Castle Member has small dimension cross beds and forms slopes. The differences in lithology between these two members suggests differences in sediment source areas and some time lapse between their depositions.

The Miners Castle Member is a soft, crumbly, silty-shaley quartz sandstone about 140 feet thick; its complete section is exposed in the Pictured Rocks Cliffs between Sand Point and Miners Castle. Sediments of this member are generally poorly sorted.

Capping the easily eroded Miners Castle Member of the Munising Formation in the western half of the Pictured Rocks, is the resistant Ordovician (430-500 million years old) Au Train formation. The Au Train Formation is a light brown to white dolomitic sandstone that forms the lip of Munising and Bridal Veil Falls.

Fossils are completely absent from the Jacobsville Formation and very rare in the Munising Formation; fragments of trilobites have been found in the Miners Castle Member. The Au Train contains

Middle Ordovician cephalopod and gastropod fossils.

Structurally, PRNL lies along the northern edge of the Michigan Basin, thus sedimentary bedding dips gently toward the south. Strata also rise very slightly eastward in the vicinity of PRNL, so that the Jacobsville, which is below lake level at Miners Castle, is well exposed to the east of Hurricane River Campground, at Au Sable Point, and in the gorge at Sable Falls.

Late Pleistocene and Holocene Geology/ Surficial Geology

During the Pleistocene epoch, ice sheets of all four North American glacial stages advanced and retreated through the area (5). The Greatlakean advance, one of the last substages of the Wisconsinan glacial period, wiped the surface clean and left only its record. This ice sheet completed its advance near the present location of Two Creeks, Wisconsin (just southeast of the city of Green Bay) about 11,850 years ago. Ice then began slowly melting, sometimes stabilizing and occasionally re-advancing short distances. A brief re-advance, the Marquette substage, occurred about 10,000 years ago in northern Upper Michigan (14; 9).

Melting of glacial ice within the Superior Basin produced huge rivers that deposited millions of tons of pulverized rock rubble in various configurations to the south of the Superior basin. A sheet of outwash, various in thickness, was deposited along the south edge of PRNL between Wetmore and Seney by southward-flowing glacial streams. The material underlying the present-day Kingston Plain was deposited in this way. Occasionally great ice blocks detached from the glacier terminus and were buried in the outwash. Eventual melting of these blocks caused surface depressions which, in some cases, became water filled. Kingston, Nevins and Grand Sable Lakes are examples of these "kettle hole lakes." The Grand Sable Banks near Grand Marais originated as a glaciofluvial crevasse filling or kame terrace.

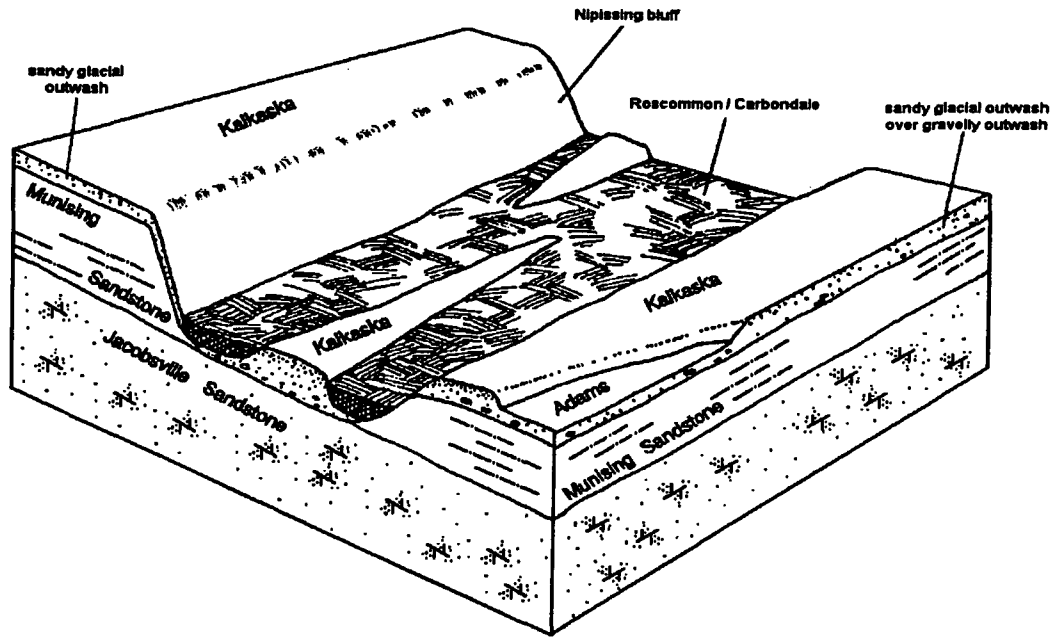


Figure 2. - Typical pattern of soils and parent material in the Beaver Basin area.

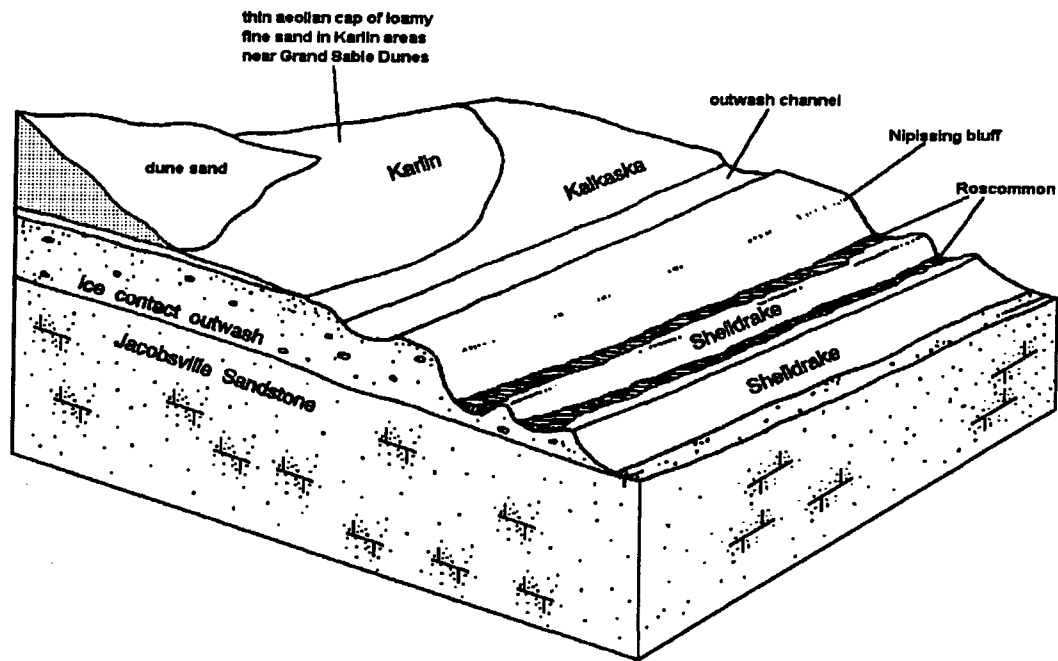


Figure 3. - Typical pattern of soils and parent material in the Grand Sable Dunes - Au Sable Point area

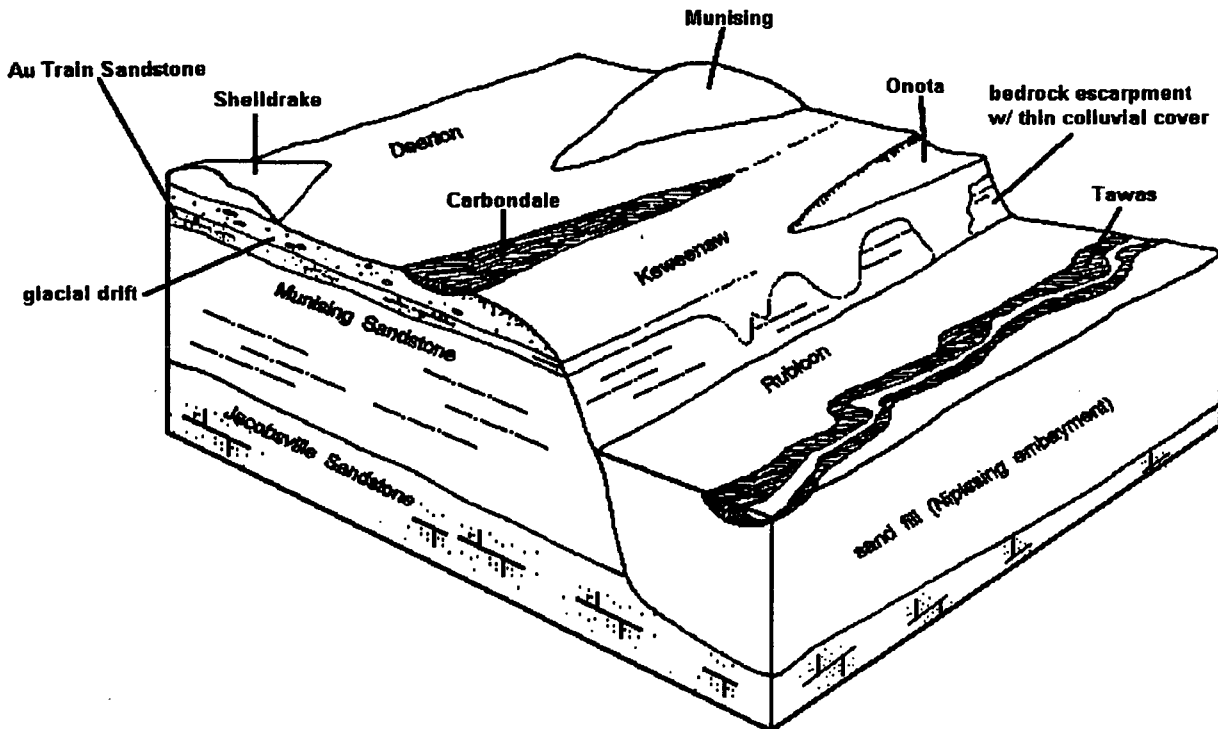


Figure 4. - Typical soil and parent material in the Miner's River area

The high band of hummocky topography adjacent to Lake Superior in central Alger Co. was initially interpreted as a terminal moraine (16; 3). Blewett and Rieck (4) suggest that the "Munising Moraine" (and the parallel "Newberry Moraine" farther south) are better portrayed as complex ice wastage features since they contain much stratified drift and lack characteristics associated with active ice.

As the Marquette ice terminus retreated northward, a series of lower drainage outlets were uncovered. The ice front confined a large west-to-east draining meltwater river against ice-free land to the south. Drainage shifted from the south (along the Au Train-Whitefish Channel), to the east along the Pictured Rocks area (6; 7). Meltwater carved several channels into Cambrian sandstone bedrock; the most prominent of these are now occupied by Chapel Creek and Mosquito River and by Beaver Basin (see figure 2). As ice retreated completely from the Superior Basin, shorelines in the basin receded rapidly northward leaving the Pictured Rocks area "high and dry" about 9500 years ago (9).

This occurred as outlet channels to the east remained at low levels due to the recent loading on the earth's crust by glacier ice.

Between 6,000 and 4,000 years before present, rebound of the earth's crust from its "depressed" state began to accelerate as land was relieved of the huge weight of the ice sheets. The rise of the outlet of ancestral Lake Superior (at North Bay, Ontario) caused the lake level to rise relatively quickly to a level roughly 40 feet higher than present Lake Superior (13; 15). This high lake stand has been designated glacial Lake Nipissing. As ancestral Lake Superior rose during the Nipissing transgression (about 5,000 years before present), the Grand Sable Banks were destabilized and part of the glaciofluvial deposit was reworked by wind to form the Grand Sable Dunes (see figure 3) (17; 10). During the Nipissing "high stand," Chapel Rock and Miners Castle as well as many less prominent features (such as perched sea caves near Little Beaver Lake Campground) were carved into the Cambrian sandstone by wave action. Beaver, Trappers, Little Beaver, Chapel, Little Chapel, and Miners

Lakes represent embayments on ancient Lake Nipissing (see figure 4).

Slowing of rebound, downcutting of channels through unconsolidated material, shifting of outlets to the south and climatic change subsequently caused a lowering of Lake Superior to near its present level[^] (9; 15). As erosion lowered the Lake Nipissing outlet to the modern Lake Superior level during a 1,600 year period, lake currents deposited a succession of parallel beach ridges from the Nipissing level to the present beach. These closely spaced ridges which form a "corrugated plain" (3), are evident in the vicinity of Au Sable Point (see figure 3), along the trail from Little Beaver Lake Campground to Lake Superior, on Sand Point and on the tombolo between Trout and Murray's Bay on Grand Island.

Since much of eastern Upper Michigan is characterized by low relief and a covering of glacial drift, bedrock only occasionally controls surface geomorphology. Where the veneer of drift is thin, as in most of PRNL, a gentle, east-west trending, southward dipping cuesta formed on the resistant Au Train formation is evident (5, p.98). Within PRNL, this cuesta comprises the Pictured Rocks themselves. All north-flowing streams in Alger County form waterfalls as they cross the cuesta (e.g. Miners Falls, Au Train Falls, Laughing Whitefish Falls).

[^][influences of differential rebound and shifting lake outlets make the regional picture of events complex and appropriately referencing past lake levels to levels of the present is difficult. Statements made herein about lake levels are meant to convey a general picture of large scale patterns only].

History, Development and Preservation

Pre-settlement History

Apparently the majority of the Pictured Rocks area was not attractive to the Indian tribes as a permanent residence, but there is evidence that the sheltered bays of

Munising and Grand Marais were the sites of aboriginal settlements. Chippewa Indian tribes occupied the PRNL area during the summer months while on fishing and berry gathering expeditions. The French missionaries and voyageurs were the first Europeans to visit the area, after entering the Upper Peninsula in 1658. Names such as Grand Marais, Les Grand Sables, and Point Aux Sables were a result of these initial visits. The British gained control of the Lake Superior region in 1763, and after the Michigan territory became a United States possession in the 19th century geologists, surveyors, Indian agents and fur trappers began to enter the area in significant numbers.

Settlement and Development History

The driving forces behind the settlement and development of the area were the iron and logging industries and the shipping associated with them. Following the discovery of iron ore in the Marquette range in the early 1800's, settlers came to the PRNL area to make their fortunes in iron smelting and logging. The area's abundant hardwood forest was used for charcoal production, which was used in the iron smelting process. The resulting pig iron was much less costly to transport than raw iron ore. The construction of the Schoolcraft Iron Co. blast furnace near Munising Falls began in May of 1867, and the first pig iron was produced on June 28, 1868. At least 29 charcoal kilns were built in the vicinity, and the company employed at one time 500 people to operate the kilns and furnace and procure hardwood for the kilns. The Munising Iron Co. assumed control of the furnace in 1872, but by 1877 it was abandoned for good after only 10 years of operation. Other furnaces outside PRNL continued to operate in the region.

Although the first interest in logging came around 1840, when the best pine forests were bought up by the early lumber barons, until 1880 logging was conducted primarily to supply the charcoal kilns. The first large scale logging operations for white pine were around the Hurricane River and Kingston Plains. The first logging camp in

the PRNL area was established in 1882 by Thomas Sullivan west of Au Sable Point in the area known today as Sullivan's Landing. This camp operated for 3 years and cut over 50 million board feet of white pine. Ten years later, a second larger white pine logging boom began. The Log Slide, located on the Grand Sable Banks, was utilized at this time. Logs were skidded to the area by teams of horses, slid down to Lake Superior and towed to sawmills in Grand Marais. Railroads were built to provide transportation for logs from inland locations. By 1897, Grand Marais was a booming sawmill town with 40 miles of railroad track and 500 men working in the woods. By 1910 the logging operations had closed and the railroads moved on.

Shipping on Lake Superior began with the early fur trading around the Great Lakes and increased with the advent of commercial fishing. Shipping boomed in response to the demand to transport iron and lumber products. Lake Superior's "Shipwreck Coast" was known as a treacherous area for shipping, and 8 shipwrecks have been located along the shore of PRNL. In response to the hazardous navigation, many US Coast Guard structures were built along the southern shore of Lake Superior. Three of these are located in PRNL, including the Park Headquarters at Sand Point, the Ranger Station at Grand Marais, and the lighthouse at Au Sable Point. The lighthouse, which was completed in August of 1874, is being restored to its original condition.

Farming within PRNL was not a major factor in the area's development. During the prosperous period of the late 1800's, farms were established to feed the local population. After the decline of the iron and logging industries, some turned to farming as an alternative source of income but met with little success.

Preservation History

The first record of interest in preserving PRNL as a public recreation site dates to August 25, 1924, when the state conservation commission voted to create a "State Park Project". In 1953, the State of

Michigan developed two separate site plans for areas in the present-day PRNL which designated the areas as state parks. A lack of adequate funding prevented the state from acquiring additional acreage to establish the parks.

The Great Lakes Shoreline Recreation Area Survey, released in early 1960, was the first involvement of the National Park Service with the Pictured Rocks area. The area was recommended for inclusion in the National Park System by the Advisory Board on National Parks, Historic Sites, Buildings and Monuments at this time. In 1961, a 100,000 acre study area was selected which included the entire watersheds of the current PRNL. Following concerns voiced by the local forest products industry, the area was scaled back to 71,397 acres and divided into a shoreline zone and an inland buffer zone. The shoreline zone was intended as the primary outdoor recreation area, with the inland buffer zone acting to stabilize and protect the existing land uses of that area. After 5 years of further studies and various bills and amendments being introduced in Congress, P.L. 89-668 became law on October 15, 1966. This law created PRNL, and the national lakeshore was formally established in October of 1972.

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 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 biologic activity.

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

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

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, soil 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.

Predictions about soil behavior are based not only on soil properties but also on such

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

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

Map Unit Composition

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

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties

and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are named and 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 Soils Handbook and the Soil Survey Manual (20) of the SCS.

Before traversing the landscape, the soil scientists compared each map sheet to the USGS topographic map for the area and stereoscopically plotted preliminary boundaries of slopes and landforms on leaf-off aerial photographs. Some traverses were made by truck on the existing network of roads and trails, but most were made on foot, at intervals of about one-fourth mile. Traverses or random observations were made at closer intervals in areas of high variability.

Soil examinations along the traverses were made wherever obvious soil boundaries were crossed. 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 5 feet. The pedons described as typical were observed and studied in 3- by 4-foot excavations.

Detailed Soil Map Units

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

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

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

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

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

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

An undifferentiated group is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in 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. Ensley and Angelica soils 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. Borrow Pits is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil map.

Table 1 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

Ad--Alluvial land

Setting

Landscape position: Level to nearly level areas adjacent to perennial streams.

Landform: Floodplains of perennial streams.

Shape of areas: Narrow and linear.

Typical Profile

This miscellaneous area occupies the floodplains of perennial streams. Most areas are poorly drained and less than 200 feet wide. This map unit is extremely variable in soil texture. These areas are subject to frequent flooding, which eliminates them from being managed for most uses except wildlife habitat.

Soil Properties and Qualities

Depth class: Very deep

Permeability: Variable

Available water capacity: Variable
Drainage class: Variable
Seasonal high water table: Variable
Surface runoff: Very slow or ponded
Flooding: Frequent

Composition

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

Inclusions

Contrasting inclusions:
 Somewhat poorly drained alluvial soils in slightly higher landscape positions
Similar inclusions:
 Areas with greater than 16 inches of muck on the surface.
 Areas with poorly drained mineral non-alluvial soils.

Use and Management

Land use: Recreation
Major management concerns: Ponding, flooding.
Management measures: Due to frequent flooding and the ponding of surface water on this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated above the average flood stage with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: 5W

AsA--Assinins sand, 0 to 3 percent slopes

Setting

Landscape position: Level and nearly level flats and depressions.
Landform: Ground moraines.
Shape of areas: Irregular

Typical Profile

Surface layer:
 0 to 2 inches--black partially decomposed organic matter
Subsurface layer:
 2 to 8 inches--mottled brown sand
Subsoil:
 8 to 13 inches--mottled reddish brown sand
 13 to 22 inches--mottled brown sand
 22 to 31 inches--mottled, mixed pinkish gray loamy sand and reddish brown sandy clay loam
Substratum:
 31 to 60 inches--reddish brown sandy loam

Soil Properties and Qualities

Depth class: Very deep
Permeability: Rapid in the upper part, moderately slow in the lower subsoil, and moderate in the substratum
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: 0.5 to 1.5 feet below the surface
Surface runoff: Slow
Flooding: None

Composition

Assinins soil and similar soils: 80 to 90 percent
 Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
 The moderately well drained Yalmer soils in slightly higher landscape positions.
 The poorly drained Ensley and Angelica soils in drainageways and depressions.
Similar inclusions:
 Areas that are deep to bedrock.

Use and Management

Land use: Recreation
Major management concerns: Wetness, sandy soil texture.
Management measures: Due to the sandy surface layer and high water table of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The

soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Controlling access to camp and picnic areas during the periods in spring or fall when this soil is wet and protecting paths and trails with wood chips or other suitable mulch material will minimize the wetness limitations. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 3W

AuB—Au Gres sand, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating flats and depressions.

Landform: Ground moraines, outwash plains and lake plains.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 3 inches--very dark gray sand

Subsurface layer:

3 to 8 inches--light brownish gray sand

Subsoil:

8 to 12 inches--mottled dark reddish brown sand

12 to 27 inches--mottled dark brown sand

Substratum:

27 to 60 inches--brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Very low

Drainage class: Somewhat poorly drained

Seasonal high water table: 0.5 to 1.5 feet below the surface

Surface runoff: Slow

Flooding: None

Composition

Au Gres soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The moderately well drained Crowell soils and well drained Rubicon soils in higher landscape positions.

The poorly drained Roscommon soils in drainageways and depressions.

Similar inclusions:

Areas that have a loamy sand surface layer.

Areas in the vicinity of Grand Marais with a loamy very fine sand eolian surface layer.

Use and Management

Land use: Recreation

Major management concerns: Wetness, sandy soil texture.

Management measures: Due to the sandy surface layer and high water table of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Controlling access to camp and picnic areas during the periods in spring or fall when this soil is wet and protecting paths and trails with wood chips or other suitable mulch material will minimize the wetness limitations. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 4W

BIB--Blue Lake sand, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating broad upland flats.

Landform: Ground moraines, end moraines and lake plains.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 1 inch--black sand

Subsurface layer:

1 to 10 inches--reddish gray sand

Subsoil:

10 to 20 inches--dark reddish brown sand

20 to 25 inches--yellowish red sand

25 to 32 inches--mixed brown sand and reddish brown fine sandy loam

Substratum:

32 to 60 inches--light brown sand with bands of reddish brown loamy sand in the upper part

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderately rapid

Available water capacity: Low

Drainage class: Well drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Very slow

Flooding: None

Composition

Blue Lake soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Blue Lake soil with steeper slopes and areas of the Karlin soil in similar landscape positions.

Similar inclusions:

Areas with firm or totally sandy subsoils.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture.

Management measures: Due to the sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Interpretive Groups

Land capability classification: 3S

BID--Blue Lake sand, 6 to 18 percent slopes

Setting

Landscape position: Gently rolling to rolling knolls, ridges and sideslopes.

Landform: Ground moraines.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 1 inch--black sand

Subsurface layer:

1 to 10 inches--reddish gray sand

Subsoil:

10 to 20 inches--dark reddish brown sand

20 to 25 inches--yellowish red sand

25 to 32 inches--mixed brown sand and reddish brown fine sandy loam

Substratum:

32 to 60 inches--light brown sand with bands of reddish brown loamy sand in the upper part

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderately rapid

Available water capacity: Low

Drainage class: Well drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Slow

Flooding: None

Composition

Blue Lake soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Blue Lake soil with gentler or steeper slopes and areas of the Karlin soil in similar landscape positions.

Similar inclusions:

Areas with firm or totally sandy subsoils.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture.

Management measures: Due to the sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Interpretive Groups

Land capability classification: 3S

BIE--Blue Lake sand, 18 to 40 percent slopes

Setting

Landscape position: Hilly to steep knolls, ridges and sideslopes.

Landform: Moraines.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 1 inch--black sand

Subsurface layer:

1 to 10 inches--reddish gray sand

Subsoil:

10 to 20 inches--dark reddish brown sand

20 to 25 inches--yellowish red sand

25 to 32 inches--mixed brown sand and reddish brown fine sandy loam

Substratum:

32 to 60 inches--light brown sand with bands of reddish brown loamy sand in the upper part

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderately rapid

Available water capacity: Low

Drainage class: Well drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Medium

Flooding: None

Composition

Blue Lake soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Blue Lake soil with gentler slopes and areas of the Munising and Karlin soils in similar landscape positions.

Similar inclusions:

Areas with totally sandy subsoils.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture, steep slope.

Management measures: Due to the steep slopes and sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is

too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation. Overcoming the slope limitations in camp and picnic areas is not practical, and paths and trails should be placed on the contours as much as possible to minimize the slope limitations.

Interpretive Groups

Land capability classification: 3R

BoB--Bohemian fine sandy loam, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating upland flats.

Landform: Lake plains.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 2 inches--black partially decomposed organic matter

Subsurface layer:

2 to 7 inches--pinkish gray fine sandy loam

Subsoil:

7 to 12 inches--reddish brown very fine sandy loam

12 to 15 inches--light brown fine sandy loam

15 to 19 inches--brown fine sandy loam

19 to 33 inches--reddish brown silt loam and loam

Substratum:

33 to 60 inches--pinkish gray stratified silt loam and very fine sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderate in the upper part and moderately slow in the lower subsoil and substratum.

Available water capacity: High

Drainage class: Well drained

Seasonal high water table: > 60 inches below the surface

Surface runoff: Slow

Flooding: None

Composition

Bohemian soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Brimley soils and the poorly drained Bruce, coarse variant soils in depressions and drainageways.

Areas of the Karlin soil in similar landscape positions.

Areas of the Bohemian soil with steeper slopes.

Similar inclusions:

Areas where the surface layer is silt loam.

Areas where the substratum is more acid.

Use and Management

Land use: Recreation

Major management concerns: Slow percolation.

Management measures: Due to the stratified silty substratum, this map unit has a slow percolation rate. This results in moderate limitations for camp and picnic areas.

Locating camp or picnic areas in this map unit will require surface drainage to remove excess surface runoff. This map unit has slight limitations for paths and trails.

Interpretive Groups

Land capability classification: 2E

BoD--Bohemian fine sandy loam, 6 to 18 percent slopes

Setting

Landscape position: Gently rolling to rolling sideslopes, knolls and ridges.

Landform: Dissected lake plains.

Shape of areas: Irregular

Typical Profile*Surface layer:*

0 to 2 inches--black partially decomposed organic matter

Subsurface layer:

2 to 7 inches--pinkish gray fine sandy loam

Subsoil:

7 to 12 inches--reddish brown very fine sandy loam

12 to 15 inches--light brown fine sandy loam

15 to 19 inches--brown fine sandy loam

19 to 33 inches--reddish brown silt loam and loam

Substratum:

33 to 60 inches--pinkish gray stratified silt loam and very fine sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderate in the upper part and moderately slow in the lower subsoil and substratum.

Available water capacity: High

Drainage class: Well drained

Seasonal high water table: > 60 inches below the surface

Surface runoff: Slow

Flooding: None

Composition

Bohemian soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions*Contrasting inclusions:*

The somewhat poorly drained Brimley soils and the poorly drained Bruce, coarse variant soils in depressions and drainageways.

Areas of the Bohemian soil with gentler or steeper slopes.

Similar inclusions:

Areas where the surface layer is silt loam.

Use and Management

Land use: Recreation

Major management concerns: Slope steepness, slow percolation.

Management measures: Due to the stratified silty substratum, this map unit has a slow percolation rate. This results in moderate limitations for camp and picnic areas. The slope steepness also contributes to the moderate limitations for camp and picnic areas. Locating camp or picnic areas in this map unit will require extensive land shaping, as well as surface drainage to remove excess surface runoff. This map unit has slight limitations for paths and trails.

Interpretive Groups

Land capability classification: 3E

Bp--Borrow pits**Setting**

Landform: Excavations in many landforms, but mainly outwash plains or eskers.

Shape of areas: Irregular and linear.

Typical Profile

This miscellaneous area occupies the site of excavations for sand or gravel. This map unit is extremely variable in soil texture, but sandy or gravelly textures are the most common.

Soil Properties and Qualities

Depth class: Very deep

Permeability: Variable

Available water capacity: Variable

Drainage class: Variable

Seasonal high water table: Variable

Surface runoff: Very slow or ponded

Flooding: None

Use and Management

Land use: Not rated for any uses.

Major management concerns: Not rated.

Management measures: Most areas need shaping and revegetating to be returned to productivity.

Interpretive Groups

Land capability classification: Not rated

Bs--Brevort mucky loamy sand**Setting**

Landscape position: Level low lying flats and depressions.

Landform: Ground moraines, outwash plains and lake plains.

Shape of areas: Irregular

Typical Profile*Surface layer:*

0 to 8 inches--black muck

8 to 10 inches--very dark gray loamy sand

Subsurface layer:

10 to 19 inches--mottled grayish brown loamy sand

Subsoil:

19 to 30 inches--mottled brown loamy sand

Substratum:

30 to 60 inches--mottled light yellowish brown loam

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid in the sandy upper part, moderately slow in the lower part

Available water capacity: Low in the sandy upper part, moderate in the lower part

Drainage class: Poorly drained

Seasonal high water table: 1 foot above to 1 foot below the surface

Surface runoff: Very slow or ponded

Flooding: None

Composition

Brevort soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions*Contrasting inclusions:*

Areas of the Iosco soil in slightly higher landscape positions.

Similar inclusions:

Areas with muck surface layers thicker than 16 inches or sandy surface layers.

Areas that lack the loamy substratum.

Use and Management

Land use: Recreation

Major management concerns: Ponding.

Management measures: Due to the ponding of surface water on this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: 5W

BtA--Brimley fine sandy loam, 0 to 4 percent slopes**Setting**

Landscape position: Level and nearly level flats and depressions.

Landform: Lake plains.

Shape of areas: Irregular

Typical Profile*Surface layer:*

0 to 6 inches--very dark grayish brown fine sandy loam

Subsurface layer:

6 to 8 inches--reddish gray silt loam

Subsoil:

8 to 15 inches--mottled dark brown very fine sandy loam

15 to 17 inches--mottled reddish gray silt loam

17 to 22 inches--mottled reddish brown silt loam

Substratum:

22 to 60 inches--stratified reddish brown silt, silt loam and very fine sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderate in the upper part and moderately slow in the silty subsoil and substratum layers

Available water capacity: High

Drainage class: Somewhat poorly drained

Seasonal high water table: 1 to 2.0 feet below the surface

Surface runoff: Slow
Flooding: None

Composition

Brimley soil and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
The poorly drained Bruce, coarse variant soils in depressions.

Similar inclusions:
Areas that are sandy throughout the profile.
Areas where the surface layer is sandy.

Use and Management

Land use: Recreation
Major management concerns: Wetness, slow percolation.
Management measures: Due to the high water table after snowmelt or excessively wet periods, this map unit has moderate limitations due to wetness for paths and trails and picnic areas and severe limitations for camp areas. The slow percolation rate also contributes to the moderate limitations for picnic areas. Controlling access to camp and picnic areas during the brief periods in spring or fall when this soil is wet will minimize these limitations. Protecting paths and trails with wood chips or other suitable mulch material can help minimize this limitation. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 2W

**Bu--Bruce mucky fine sandy loam,
Coarse Variant**

Setting

Landscape position: Level low lying flats and depressions.

Landform: Lake plains.

Shape of areas: Irregular

Typical Profile

Surface layer:
0 to 5 inches--black muck
5 to 7 inches--very dark gray fine sandy loam

Subsoil:
7 to 10 inches--mottled grayish brown very fine sandy loam
10 to 15 inches--mottled pinkish gray loamy very fine sand

Stratum:
15 to 60 inches--mottled light reddish brown loamy very fine sand with thin lenses of silt loam and loamy sand

Soil Properties and Qualities

Depth class: Very deep
Permeability: Moderate
Available water capacity: High
Drainage class: Poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface
Surface runoff: Very slow or ponded
Flooding: None

Composition

Bruce, coarse variant soil and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
Areas of the somewhat poorly drained Brimley and Wainola soils in slightly higher landscape positions.

Similar inclusions:
Areas with muck surface layers up to 12 inches thick.

Use and Management

Land use: Recreation
Major management concerns: Ponding, excess humus.
Management measures: Due to the ponding of surface water and the muck surface layer of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome

them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: 5W

BwC--Burt mucky sandy loam, 2 to 12 percent slopes

Setting

Landscape position: Nearly level to gently rolling low lying flats, ridges and depressions.

Landform: Sandstone benches.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 5 inches--very dark gray mucky sandy loam

Subsurface layer:

5 to 11 inches--mottled grayish brown sand

Subsoil:

11 to 17 inches--mottled light brownish gray sand

Substratum:

17 to 26 inches--gray and light brownish gray highly weathered sandstone bedrock

26 inches--sandstone bedrock

Soil Properties and Qualities

Depth class: Shallow

Permeability: Rapid

Available water capacity: Low

Drainage class: Poorly drained

Seasonal high water table: 6 inches above to 1 foot below the surface

Surface runoff: Very slow or ponded

Flooding: None

Composition

Burt soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

Areas of the somewhat poorly drained Kawbawgam (and Sundell, sandy variant soils in the vicinity of Grand Marais) soils in slightly higher landscape positions.

Similar inclusions:

Areas with depths to paralithic contact greater than 20 inches or less than 10 inches.

Use and Management

Land use: Recreation

Major management concerns: Ponding, depth to rock.

Management measures: Due to the ponding of surface water and the shallow depth to bedrock of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: 7W

Cb--Carbondale, Lupton and Rifle soils

Setting

Landscape position: Level low lying flats and depressions.

Landform: Swamps on till plains, outwash plains and lake plains.

Shape of areas: Irregular or linear

Typical Profile

Carbondale

Surface layer:

0 to 4 inches--black mucky peat

Subsurface layer:

4 to 32 inches--black muck

Subsoil:

32 to 52 inches--dark reddish brown mucky peat

Substratum:

52 to 60 inches--dark grayish brown mucky peat

Lupton*Surface layer:*

0 to 3 inches--black mucky peat

Subsurface layer:

3 to 46 inches--black muck

Subsoil:

46 to 59 inches--very dark brown mucky peat

Substratum:

59 to 73 inches--black mucky peat

Rifle*Surface layer:*

0 to 4 inches--yellowish brown and black peat

Subsurface layer:

4 to 8 inches--black muck

Subsoil:

8 to 39 inches--dark reddish brown mucky peat

Substratum:

39 to 60 inches--dark reddish brown mucky peat

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderately rapid to moderately slow.

Available water capacity: High.

Drainage class: Very poorly drained

Seasonal high water table: 1 foot above to 1 foot below the surface

Surface runoff: Very slow or ponded

Flooding: None

Composition

Some delineations of this map unit contain all three soils while some contain only one. The main difference in the soils is the degree of decomposition of the organic layers. The soils are so similar in use and management that it is not practical to separate them in mapping.

Carbondale soil and similar soils: 0 to 95 percent

Lupton soil and similar soils: 0 to 95 percent

Rifle soil and similar soils: 0 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions*Contrasting inclusions:*

Areas of the poorly drained Ensley and Angelica soils in slightly higher landscape positions and at the edge of map units.

Areas with slopes up to 8 percent

Similar inclusions:

Areas with less than 16 inches of muck on the surface.

Areas with sandstone bedrock within 51 inches.

Areas with mineral soil within 51 inches.

Use and Management

Land use: Recreation

Major management concerns: Ponding, excess humus.

Management measures: Due to the ponding of surface water and the organic surface layer of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: 6W

Ck--Cathro and Tacoosh mucks**Setting**

Landscape position: Level low lying flats and depressions.

Landform: Swamps on ground moraines.

Shape of areas: Irregular or linear

Typical Profile**Cathro***Surface layer:*

0 to 4 inches--black muck

Subsurface layer:

4 to 11 inches--black mucky peat

Subsoil:

11 to 23 inches--black muck

Substratum:

23 to 60 inches--grayish brown sandy loam

Tacoosh*Surface layer:*

0 to 8 inches--black muck

Subsurface layer:

8 to 40 inches--black, dark reddish brown and very dark grayish brown mucky peat

Subsoil:

40 to 42 inches--grayish brown very fine sandy loam

Substratum:

42 to 60 inches--light brownish gray sandy loam

Soil Properties and Qualities*Depth class:* Very deep*Permeability:* Moderately rapid to moderately slow in the organic layers and moderate in the substratum.*Available water capacity:* High.*Drainage class:* Very poorly drained*Seasonal high water table:* 1 foot above to 1 foot below the surface*Surface runoff:* Very slow or ponded*Flooding:* None**Composition**

Some delineations of this map unit contain both soils while some contain only one. The main difference in the soils is the degree of decomposition of the organic layers. The soils are so similar in use and management that it is not practical to separate them in mapping.

Cathro soil and similar soils: 0 to 95 percent
Tacoosh soil and similar soils: 0 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions*Contrasting inclusions:*

Areas of the poorly drained Ensley and Angelica soils in slightly higher landscape positions and at the edge of map units.

Similar inclusions:

Areas with less 16 inches of muck on the surface.

Areas with sandstone bedrock within 51 inches.

Areas with organic layers greater than 51 inches thick.

Use and Management**Land use:** Recreation*Major management concerns:* Ponding, excess humus.

Management measures: Due to the ponding of surface water and the muck surface layer of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups*Land capability classification:* 6W**CmD--Chatham fine sandy loam , 6 to 18 percent slopes****Setting***Landscape position:* Gently rolling to rolling sideslopes, knolls and ridges.*Landform:* Ground moraines.*Shape of areas:* Irregular**Typical Profile***Surface layer:*

0 to 6 inches--very dark gray fine sandy loam

Subsurface layer:

6 to 9 inches--brown fine sandy loam

Subsoil:

9 to 13 inches--dark reddish brown fine sandy loam

13 to 23 inches--dark brown and yellowish red sandy loam

Substratum:

23 to 60 inches--brown and dark yellowish brown gravelly loamy sand

Soil Properties and Qualities

Depth class: Very deep
Permeability: Moderately rapid.
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: >60 inches below the surface
Surface runoff: Medium
Flooding: None

Composition

Chatham soil and similar soils: 80 to 90 percent
 Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
 Somewhat poorly drained and poorly drained soils in depressions and drainageways. Areas of the Chatham soil with steeper or gentler slopes.
Similar inclusions:
 Areas with a higher percentage of cobbles and flags.

Use and Management

Land use: Recreation
Major management concerns: Slope steepness.
Management measures: This map unit has moderate limitations for camp and picnic areas due to slope. Minor land shaping will be necessary to convert the site to those uses. The limitations are slight for paths and trails.

Interpretive Groups

Land capability classification: 4E

Cn--Chippeny muck

Setting

Landscape position: Level to gently rolling depressional areas and hillside seepage areas.
Landform: Sandstone benches and till plains.
Shape of areas: Irregular or linear

Typical Profile

Surface layer:
 0 to 6 inches--black muck
Subsurface layer:
 6 to 20 inches--very dark gray muck
Substratum:
 20 to 28 inches--dark grayish brown silty clay loam
 28 inches--sandstone bedrock (This series typically is underlain by limestone bedrock.)

Soil Properties and Qualities

Depth class: Moderately deep or deep
Permeability: Moderately slow
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface
Surface runoff: Very slow or ponded
Flooding: None

Composition

Burt soil and similar soils: 80 to 90 percent
 Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
 Areas of the somewhat poorly drained Kawbawgam (and Sundell, sandy variant soils in the vicinity of Grand Marais) soils in slightly higher landscape positions.

Similar inclusions:
 Areas with depths to bedrock greater than 51 inches or less than 20 inches.
 Areas with greater than 51 inches of muck over mineral soil.
 Areas with less 16 inches of muck on the surface.

Use and Management

Land use: Recreation
Major management concerns: Ponding, excess humus.
Management measures: Due to the ponding of surface water and the muck surface layer of this map unit, the area has severe limitations for camp areas, picnic areas, and

paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: 7W

CrA--Crowell sand, 0 to 4 percent slopes

Setting

Landscape position: Level and nearly level upland flats and slight depressions.

Landform: Outwash plains, lake plains and stream terraces.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 2 inches--black organic matter and reddish gray sand

Subsurface layer:

2 to 5 inches--reddish gray sand

Subsoil:

5 to 10 inches--reddish brown sand

10 to 20 inches--strong brown sand

20 to 28 inches--brown sand

Substratum:

28 to 40 inches--mottled light yellowish brown sand

40 to 60 inches--light brown sand (mottled in the upper 5 inches)

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Moderately well drained

Seasonal high water table: 2 to 5 feet below the surface

Surface runoff: Very slow

Flooding: None

Composition

Crowell soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Similar inclusions:

Areas that lack mottling in the substratum.

Areas with darker subsoils.

Areas where the substratum is gravelly sand.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture

Management measures: Due to the sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Interpretive Groups

Land capability classification: 4S

Dd--Dawson and Greenwood peats

Setting

Landscape position: Level low lying flats and depressions.

Landform: Acid bogs on outwash plains and lake plains.

Shape of areas: Irregular or circular

Typical Profile

Dawson

Surface layer:

0 to 8 inches--dark reddish brown extremely acid peat

Subsurface layer:

8 to 38 inches--dark reddish brown extremely acid muck

Subsoil:

38 to 40 inches--very dark gray silt loam

Substratum:

40 to 60 inches--grayish brown sand

Greenwood

Surface layer:

0 to 4 inches--yellowish brown extremely acid peat

Subsurface layer:

4 to 10 inches--very dark grayish brown and dark brown extremely acid peat

Substratum:

10 to 62 inches--dark reddish brown extremely acid mucky peat

Soil Properties and Qualities

Depth class: Very deep

Permeability: Dawson--moderately rapid in the organic layers and rapid in the substratum; Greenwood--moderately rapid.

Available water capacity: High.

Drainage class: Very poorly drained

Seasonal high water table: 1 foot above to 1 foot below the surface

Surface runoff: Very slow or ponded

Flooding: None

Composition

Some delineations of this map unit contain both soils while some contain only one. The main difference in the soils is the thickness of the organic layers. The soils are so similar in used management that it is not practical to separate them in mapping.

Dawson soil and similar soils: 0 to 95 percent

Greenwood soil and similar soils: 0 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

Areas of the somewhat poorly drained Au Gres soils in slightly higher landscape positions and at the edge of map units.

Similar inclusions:

Areas with less 16 inches of muck on the surface.

Use and Management

Land use: Recreation

Major management concerns: Ponding, excess humus.

Management measures: Due to the ponding of surface water and the peat surface layer of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: 7W

DeB--Deerton sand, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating upland flats.

Landform: Sandstone benches and till plains.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 1 inch--black organic matter and very dark gray sand

Subsurface layer:

1 to 8 inches--pinkish gray sand

Subsoil:

8 to 9 inches--dark reddish brown loamy sand

9 to 24 inches--reddish brown sand

Substratum:

24 to 38 inches--dark yellowish brown and very pale brown highly weathered sandstone
38 inches--sandstone bedrock

Soil Properties and Qualities

Depth class: Moderately deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Somewhat excessively drained

Seasonal high water table: Briefly perched on bedrock following snowmelt.

Surface runoff: Slow

Flooding: None

Composition

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

Inclusions

Contrasting inclusions:

The somewhat poorly drained Kawbawgam and the poorly drained Burt soils in depressions and drainageways. Areas of the Deerton soil with steeper slopes.

Similar inclusions:

Areas with loamy textures.
 Areas where the bedrock is deeper or shallower.
 Areas in the vicinity of Grand Marais with a loamy very fine sand eolian cap overlying the sand.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture.

Management measures: Due to the sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Interpretive Groups

Land capability classification: 4S

DeD--Deerton sand, 6 to 18 percent slopes

Setting

Landscape position: Gently rolling to rolling sideslopes, knolls and ridges.

Landform: Sandstone benches and till plains.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 1 inch--black organic matter and very dark gray sand

Subsurface layer:

1 to 8 inches--pinkish gray sand

Subsoil:

8 to 9 inches--dark reddish brown loamy sand

9 to 24 inches--reddish brown sand

Substratum:

24 to 38 inches--dark yellowish brown and very pale brown highly weathered sandstone
 38 inches--sandstone bedrock

Soil Properties and Qualities

Depth class: Moderately deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Somewhat excessively drained

Seasonal high water table: Briefly perched on bedrock following snowmelt.

Surface runoff: Slow

Flooding: None

Composition

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

Inclusions

Contrasting inclusions:

The somewhat poorly drained Kawbawgam and the poorly drained Burt soils in depressions and drainageways. Areas of the Deerton soil with steeper slopes.

Similar inclusions:

Areas with loamy textures.
 Areas where the bedrock is deeper or shallower.

Areas in the vicinity of Grand Marais with a loamy very fine sand eolian cap overlying the sand.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture.

Management measures: Due to the sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Interpretive Groups

Land capability classification: 4S

DIB--Deerton-Burt complex, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating upland flats and depressions.

Landform: Sandstone benches and till plains.

Shape of areas: Irregular

Typical Profile

Deerton

Surface layer:

0 to 1 inch--black organic matter and very dark gray sand

Subsurface layer:

1 to 8 inches--pinkish gray sand

Subsoil:

8 to 9 inches--dark reddish brown loamy sand

9 to 24 inches--reddish brown sand

Substratum:

24 to 38 inches--dark yellowish brown and very pale brown highly weathered sandstone
38 inches--sandstone bedrock

Burt

Surface layer:

0 to 5 inches--very dark gray mucky sandy loam

Subsurface layer:

5 to 11 inches--mottled grayish brown sand

Subsoil:

11 to 17 inches--mottled light brownish gray sand

Substratum:

17 to 26 inches--gray and light brownish gray highly weathered sandstone bedrock

26 inches--sandstone bedrock

Soil Properties and Qualities

Depth class: Deerton--moderately deep;

Burt--shallow

Permeability: Rapid

Available water capacity: Low

Drainage class: Deerton--somewhat

excessively drained; Burt--poorly drained

Seasonal high water table: Deerton--briefly

perched on bedrock following snowmelt;

Burt--0.5 to 1.0 feet below the surface.

Surface runoff: Deerton--slow; Burt--very slow or ponded

Flooding: None

Composition

Deerton soil and similar soils: 45 to 65 percent

Burt soil and similar soils: 25 to 45 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Sundell, sandy variant soils in depressions and drainageways.

Areas of the Deerton soil with steeper slopes.

Similar inclusions:

Areas with loamy very fine sand textures in the vicinity of Grand Marais.

Areas where the depth to bedrock is less than 10 inches or greater than 40 inches.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture, ponding, depth to rock.

Management measures: Due to the sandy nature of the Deerton soil and the ponding of surface water and shallow depth to bedrock

of the Burt soil, the area has severe limitations for camp areas, picnic areas, and paths and trails. The Deerton soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation. The limitations of the Burt soil are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross the Burt soil must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: Deerton--4S;
Burt--7W

Dn--Duneland, moderately sloping to steep

Setting

Landscape position: Gently sloping to steep knolls, ridges and sideslopes.

Landform: Grand Sable Dunes.

Shape of areas: Irregular

Typical Profile

This miscellaneous area occupies the Grand Sable Dunes and consists of eolian sand deposits that are highly variable in sand grain size. Much of the area is subject to soil blowing except for a few sheltered coves where jack pine or beachgrass has become established. The area is not stable enough to have developed a soil profile, but parts of this map unit has a buried profile of a former spodosol, as well as loamy and gravelly strata exposed at a relatively constant elevation.

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Excessively drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Slow

Flooding: None

Composition

Duneland and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

Areas with a spodic profile over a substratum of gravelly sand.

Similar inclusions:

Areas with buried loamy or gravelly layers.

Areas with buried spodic profiles.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture, steep slopes.

Management measures: Due to the steep slopes and sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Overcoming the slope limitations in camp and picnic areas is not practical, and paths and trails should be placed on the contours as much as possible to minimize the slope limitations.

Interpretive Groups

Land capability classification: 8S

DnG--Duneland, very steep

Setting

Landscape position: Very steep escarpment on Lake Superior.

Landform: Escarpment on lakeside edge of Grand Sable dunes.

Shape of areas: linear

Typical Profile

This miscellaneous area occupies the Grand Sable Banks and consists of eolian sand deposits that are highly variable in sand grain size. Most of the area is actively eroding with the exception of a few sheltered coves where vegetation has become established. The area is not stable enough to have developed a soil profile, but most of this map unit has a buried profile of a former spodosol, as well as loamy and gravelly strata exposed at a relatively constant elevation.

Soil Properties and Qualities

Depth class: Very deep
Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: >60 inches below the surface
Surface runoff: Rapid
Flooding: None

Composition

Duneland, very steep and similar soils: 85 to 95 percent
 Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
 Level to nearly level sandy beach deposits and talus slopes at the base of the Grand Sable Banks.
Similar inclusions:
 Areas with buried loamy or gravelly layers.
 Areas with buried spodic profiles.

Use and Management

Land use: Recreation
Major management concerns: Sandy soil texture, steep slopes.
Management measures: Due to the steep slopes and sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. Because of the location and sensitive nature of these soils, use is limited. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and

loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation. Overcoming the slope limitations in camp and picnic areas is not practical, and paths and trails should be placed on the contours as much as possible to minimize the slope limitations.

Interpretive Groups

Land capability classification: 8S

EcB--Adams loamy sand, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating broad upland flats.
Landform: Outwash plains and stream terraces.
Shape of areas: Irregular

Typical Profile

Surface layer:
 0 to 2 inches--very dark grayish brown loamy sand
Subsurface layer:
 2 to 5 inches--brown loamy sand
Subsoil:
 5 to 13 inches--dark brown loamy sand
 13 to 26 inches--dark reddish brown loamy sand
Substratum:
 26 to 60 inches--brown to reddish brown sand and gravel

Soil Properties and Qualities

Depth class: Very deep
Permeability: Rapid in the upper horizons and very rapid in the substratum.
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: >60 inches below the surface
Surface runoff: Slow
Flooding: None

Composition

Adams soil and similar soils: 80 to 90 percent
 Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Adams soil with steeper slopes.

Similar inclusions:

Areas with sand surface layers and less gravel in the substratum.

Use and Management

Land use: Recreation

Major management concerns: None.

Management measures: This map unit has slight limitations for camp areas, picnic areas and paths and trails.

Interpretive Groups

Land capability classification: 3S

EcD--Adams loamy sand, 6 to 18 percent slopes

Setting

Landscape position: Gently rolling to rolling sideslopes, knolls and ridges.

Landform: Outwash plains and stream terraces.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 2 inches--very dark grayish brown loamy sand

Subsurface layer:

2 to 5 inches--brown loamy sand

Subsoil:

5 to 13 inches--dark brown loamy sand

13 to 26 inches--dark reddish brown loamy sand

Substratum:

26 to 60 inches--brown to reddish brown sand and gravel

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid in the upper horizons and very rapid in the substratum.

Available water capacity: Low

Drainage class: Somewhat excessively drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Slow

Flooding: None

Composition

Adams soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Adams soil with steeper or gentler slopes.

Similar inclusions:

Areas with sand surface layers and less gravel in the substratum.

Areas with a higher percentage of cobbles on the surface.

Use and Management

Land use: Recreation

Major management concerns: Slope steepness.

Management measures: This map unit has moderate limitations for camp and picnic areas due to slope. Minor land shaping will be necessary to convert the site to those uses. The limitations are slight for paths and trails.

Interpretive Groups

Land capability classification: 4E

EkB--Adams-Kalkaska complex, 0 to 6 percent slopes**Setting**

Landscape position: Nearly level to undulating broad upland flats.

Landform: Outwash plains and stream terraces.

Shape of areas: Irregular

Typical Profile**Adams***Surface layer:*

0 to 2 inches--very dark grayish brown loamy sand

Subsurface layer:

2 to 5 inches--brown loamy sand

Subsoil:

5 to 13 inches--dark brown loamy sand

13 to 26 inches--dark reddish brown loamy sand

Substratum:

26 to 60 inches--brown to reddish brown sand and gravel

Kalkaska*Surface layer:*

0 to 2 inches--black partially decomposed leaf litter

Subsurface layer:

2 to 12 inches--pinkish gray sand

Subsoil:

12 to 19 inches--dark reddish brown sand

19 to 29 inches--strong brown sand

Substratum:

29 to 60 inches--light brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Adams--Rapid in the upper horizons and very rapid in the substratum; Kalkaska--Rapid.

Available water capacity: Low

Drainage class: Somewhat excessively drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Slow

Flooding: None

Composition

Adams soil and similar soils: 45 to 60 percent

Kalkaska soil and similar soils: 30 to 50 percent

Contrasting inclusions: 5 to 15 percent

Inclusions*Contrasting inclusions:*

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of both soils with steeper slopes.

Similar inclusions:

Areas with mottling in the substratum.

Areas of the Adams soil with a sand surface layer.

Use and Management

Land use: Recreation

Major management concerns: Sandy texture of the Kalkaska soil.

Management measures: Due to the sandy nature of the Kalkaska soil, that portion of this map unit has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation. The Adams portion of this map unit has slight limitations for camp areas, picnic areas and paths and trails.

Interpretive Groups

Land capability classification: Adams--3S; Kalkaska--4S

EkD--Adams-Kalkaska complex, 6 to 18 percent slopes**Setting**

Landscape position: Gently rolling to rolling sideslopes, knolls and ridges.

Landform: Outwash plains and stream terraces.

Shape of areas: Irregular

Typical Profile

Adams

Surface layer:

0 to 2 inches--very dark grayish brown loamy sand

Subsurface layer:

2 to 5 inches--brown loamy sand

Subsoil:

5 to 13 inches--dark brown loamy sand
13 to 26 inches--dark reddish brown loamy sand

Substratum:

26 to 60 inches--brown to reddish brown sand and gravel

Kalkaska

Surface layer:

0 to 2 inches--black partially decomposed leaf litter

Subsurface layer:

2 to 12 inches--pinkish gray sand

Subsoil:

12 to 19 inches--dark reddish brown sand
19 to 29 inches--strong brown sand

Substratum:

29 to 60 inches--light brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Adams--Rapid in the upper horizons and very rapid in the substratum; Kalkaska--Rapid.

Available water capacity: Low

Drainage class: Somewhat excessively drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Slow

Flooding: None

Composition

Adams soil and similar soils: 45 to 60 percent

Kalkaska soil and similar soils: 30 to 50 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of both soils with gentler or steeper slopes.

Similar inclusions:

Areas of the Adams soil with a sand surface layer.

Use and Management

Land use: Recreation

Major management concerns: Slope, Sandy texture of the Kalkaska soil.

Management measures: The Adams portion of this map unit has moderate limitations for camp and picnic areas due to slope, and slight limitations for paths and trails. Minor land shaping will be necessary to convert the site to camp or picnic areas. Due to the sandy nature of the Kalkaska soil, that portion of this map unit has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Interpretive Groups

Land capability classification: Adams--4E; Kalkaska--6S

EkE--Adams-Kalkaska complex, 18 to 40 percent slopes

Setting

Landscape position: Hilly to steep knolls, ridges and sideslopes.

Landform: Outwash plains and stream terraces.

Shape of areas: Irregular

Typical Profile

Adams

Surface layer:

0 to 2 inches--very dark grayish brown loamy sand

Subsurface layer:

2 to 5 inches--brown loamy sand

Subsoil:

5 to 13 inches--dark brown loamy sand
13 to 26 inches--dark reddish brown loamy sand

Substratum:

26 to 60 inches--brown to reddish brown sand and gravel

Kalkaska

Surface layer:

0 to 2 inches--black partially decomposed leaf litter

Subsurface layer:

2 to 12 inches--pinkish gray sand

Subsoil:

12 to 19 inches--dark reddish brown sand
19 to 29 inches--strong brown sand

Substratum:

29 to 60 inches--light brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Adams--Rapid in the upper horizons and very rapid in the substratum; Kalkaska--Rapid.

Available water capacity: Low

Drainage class: Somewhat excessively drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Medium

Flooding: None

Composition

Adams soil and similar soils: 45 to 60 percent

Kalkaska soil and similar soils: 30 to 50 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of both soils with gentler slopes.

Similar inclusions:

Areas of the Adams soil with a sand surface layer.

Use and Management

Land use: Recreation

Major management concerns: Slope, Sandy texture of the Kalkaska soil.

Management measures: Due to the steep slopes on both soils and sandy nature of the Kalkaska soil, the area has severe limitations for camp areas, picnic areas, and paths and trails. The Kalkaska soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation. Overcoming the slope limitations in camp and picnic areas is not practical, and paths and trails should be placed on the contours as much as possible to minimize the slope limitations.

Interpretive Groups

Land capability classification: Adams--6E; Kalkaska--7S

Es--Ensley and Angelica soils

Setting

Landscape position: Level low lying flats and depressions.

Landform: Swamps on till plains.

Shape of areas: Irregular or linear

Typical Profile

Ensley

Surface layer:

0 to 2 inches--black muck

Subsurface layer:

2 to 6 inches--black sandy loam

Subsoil:

6 to 12 inches--grayish brown fine sandy loam
 12 to 16 inches--mottled light brownish gray sandy loam
 16 to 22 inches--mottled reddish brown sandy clay loam
 22 to 32 inches--reddish brown sandy loam
Substratum:
 32 to 60 inches--reddish brown sandy loam

Angelica**Surface layer:**

0 to 2 inches--black muck

Subsurface layer:

2 to 6 inches--very dark gray loam

Subsoil:

6 to 10 inches--mottled grayish brown sandy loam
 10 to 14 inches--mottled dark brown loam
 14 to 17 inches--mottled reddish brown sandy clay loam
Substratum:
 17 to 60 inches--mottled light brown loam

Soil Properties and Qualities

Depth class: Very deep

Permeability: Ensley--moderate; Angelica--moderately slow.

Available water capacity: Ensley--moderate; Angelica--high.

Drainage class: Poorly drained

Seasonal high water table: 1 foot above to 1 foot below the surface

Surface runoff: Very slow or ponded

Flooding: None

Composition

Some delineations of this map unit contain both soils while some contain only one. The main difference in the soils is the Ensley soil formed in sandy loam material and the Angelica soil formed in loam material. The soils are so similar in use and management that it is not practical to separate them in mapping.

Ensley soil and similar soils: 0 to 95 percent
 Angelica soil and similar soils: 0 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions**Contrasting inclusions:**

Areas of the very poorly drained Cathro and Tacoosh soils in slightly lower landscape positions and in the center of map units.

Similar inclusions:

Areas with sandstone bedrock within 40 inches.

Use and Management

Land use: Recreation

Major management concerns: Ponding, excess humus.

Management measures: Due to the ponding of surface water on this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: 5W

Gw--Greenwood peat**Setting**

Landscape position: Level low lying flats and depressions.

Landform: Outwash plains, lake plains and till plains.

Shape of areas: Irregular or circular

Typical Profile**Surface layer:**

0 to 4 inches--yellowish brown extremely acid peat

Subsurface layer:

4 to 10 inches--very dark grayish brown and dark brown extremely acid peat

Substratum:

10 to 62 inches--dark reddish brown extremely acid mucky peat

Soil Properties and Qualities

Depth class: Very deep

Permeability: 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
Surface runoff: Very slow or ponded
Flooding: None

Composition

Greenwood soil and similar soils: 80 to 90 percent
 Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
 Areas of the somewhat poorly drained Au Gres soils in slightly higher landscape positions.

Similar inclusions:
 Areas with less than 51 inches of muck over mineral soil.
 Areas with less than 16 inches of muck on the surface.

Use and Management

Land use: Recreation
Major management concerns: Ponding, excess humus.
Management measures: Due to the ponding of surface water and the muck surface layer of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: TW

HaB--Halfaday sand, 0 to 4 percent slopes

Setting

Landscape position: Level and nearly level upland flats and slight depressions.
Landform: Outwash plains, ground moraines.
Shape of areas: Irregular

Typical Profile

Surface layer:
 0 to 1 inch--black sand
Subsurface layer:
 1 to 7 inches--brown sand
Subsoil:
 7 to 13 inches--dark reddish brown sand
 13 to 17 inches--dark brown and strong brown weakly cemented sand
 17 to 30 inches--dark brown and brownish yellow mottled sand
 30 to 37 inches--mottled yellowish brown sand
Substratum:
 37 to 60 inches--mottled brownish yellow sand

Soil Properties and Qualities

Depth class: Very deep
Permeability: Rapid
Available water capacity: Low
Drainage class: Moderately well drained
Seasonal high water table: 2 to 3.5 feet below the surface
Surface runoff: Very slow
Flooding: None

Composition

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

Inclusions

Contrasting inclusions:
 The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.
Similar inclusions:
 Areas that lack mottling in the subsoil and substratum.
 Areas with lighter colored subsoils.
 Areas where the substratum is gravelly sand.

Use and Management

Land use: Recreation
Major management concerns: Sandy soil texture
Management measures: Due to the sandy nature of this map unit, the area has severe

limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Interpretive Groups

Land capability classification: 3S

IoB--Iosco sand, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating flats and depressions.

Landform: Lake plains and till plains.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 3 inches--black partially decomposed forest litter

Subsurface layer:

3 to 15 inches--pinkish gray sand

Subsoil:

15 to 18 inches--mottled dark reddish brown sand

18 to 25 inches--mottled dark brown sand

25 to 32 inches--mottled strong brown sand

32 to 35 inches--mottled reddish brown clay loam

Substratum:

35 to 60 inches--reddish brown loam

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid in the sandy upper layers and moderately slow in the loamy layers

Available water capacity: Low

Drainage class: Somewhat poorly drained

Seasonal high water table: 0.5 to 1.5 feet below the surface

Surface runoff: Slow

Flooding: None

Composition

Iosco soil and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The poorly drained Brevort soils in drainageways and depressions.

Similar inclusions:

Areas that have a loamy sand surface layer.
Areas that have a sandy lower subsoil and substratum.

Use and Management

Land use: Recreation

Major management concerns: Wetness, sandy soil texture.

Management measures: Due to the sandy surface layer and high water table of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Controlling access to camp and picnic areas during the periods in spring or fall when this soil is wet and protecting paths and trails with wood chips or other suitable mulch material will minimize the wetness limitations. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 3W

Jb--Jacobsville-Burt complex

Setting

Landscape position: Level low lying flats and depressions.

Landform: Bedrock controlled till plains.

Shape of areas: Irregular or linear

Typical Profile

Jacobsville

Surface layer:

0 to 5 inches--black muck

Subsurface layer:

5 to 9 inches--mottled dark reddish gray sandy loam

Subsoil:

9 to 23 inches--mottled dark reddish brown sandy loam

Stratum:

23 to 36 inches--mottled reddish brown sandy loam

36 inches--sandstone bedrock

Burt

Surface layer:

0 to 5 inches--very dark gray mucky sandy loam

Subsurface layer:

5 to 11 inches--mottled grayish brown sand

Subsoil:

11 to 17 inches--mottled light brownish gray sand

Stratum:

17 to 26 inches--gray and light brownish gray highly weathered sandstone bedrock

26 inches--sandstone bedrock

Soil Properties and Qualities

Depth class: Jacobsville--moderately deep;

Burt--shallow

Permeability: Jacobsville--Moderate; Burt--rapid

Available water capacity: Low

Drainage class: Poorly drained

Seasonal high water table: 6 inches above to 1 foot below the surface

Surface runoff: Very slow or ponded

Flooding: None

Composition

Jacobsville soil and similar soils: 50 to 60 percent

Burt soil and similar soils: 30 to 45 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

Areas of the somewhat poorly drained Kawbawgam (and Sundell, sandy variant soils in the vicinity of Grand Marais) soils in slightly higher landscape positions.

Similar inclusions:

Areas with depths to bedrock greater than 40 inches or less than 10 inches.

Areas in the vicinity of Grand Marais with a mucky loamy very fine sand surface.

Use and Management

Land use: Recreation

Major management concerns: Ponding, excess humus, depth to rock.

Management measures: Due to the ponding of surface water, the organic surface layer of the Jacobsville soil and the shallow depth to bedrock of the Burt soil, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: Jacobsville--5W; Burt--7W

KaB--Kalkaska sand, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating upland flats.

Landform: Outwash terraces, stream terraces, moraines.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 2 inches--black partially decomposed leaf litter

Subsurface layer:

2 to 12 inches--pinkish gray sand

Subsoil:

12 to 19 inches--dark reddish brown sand

19 to 29 inches--strong brown sand

Substratum:

29 to 60 inches--light brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Somewhat excessively drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Very slow

Flooding: None

Composition

Kalkaska soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions**Contrasting inclusions:**

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Kalkaska soil with steeper slopes.

Similar inclusions:

Areas with lighter colored subsoils.

Areas where the substratum is gravelly sand.

Areas with mottling below 40 inches.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture.

Management measures: Due to the sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Interpretive Groups

Land capability classification: 4S

KaD--Kalkaska sand, 6 to 18 percent slopes

Setting

Landscape position: Gently rolling to rolling sideslopes, knolls and ridges.

Landform: Outwash terraces, stream terraces, moraines.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 2 inches--black partially decomposed leaf litter

Subsurface layer:

2 to 12 inches--pinkish gray sand

Subsoil:

12 to 19 inches--dark reddish brown sand

19 to 29 inches--strong brown sand

Substratum:

29 to 60 inches--light brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Somewhat excessively drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Slow

Flooding: None

Composition

Kalkaska soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions**Contrasting inclusions:**

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Kalkaska soil with steeper or gentler slopes.

Similar inclusions:

Areas with lighter colored subsoils.
Areas where the substratum is gravelly sand.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture.

Management measures: Due to the sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Interpretive Groups

Land capability classification: 6S

KaE--Kalkaska sand, 18 to 40 percent slopes

Setting

Landscape position: Hilly to steep sideslopes, knolls and ridges.

Landform: Glacial lake shorelines, stream terraces, moraines.

Shape of areas: Irregular to linear

Typical Profile*Surface layer:*

0 to 2 inches--black partially decomposed leaf litter

Subsurface layer:

2 to 12 inches--pinkish gray sand

Subsoil:

12 to 19 inches--dark reddish brown sand

19 to 29 inches--strong brown sand

Substratum:

29 to 60 inches--light brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Somewhat excessively drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Slow

Flooding: None

Composition

Kalkaska soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions*Contrasting inclusions:*

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Kalkaska soil with gentler slopes.

Similar inclusions:

Areas with lighter colored subsoils.

Areas where the substratum is gravelly sand.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture, steep slopes.

Management measures: Due to the steep slopes and sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Overcoming the slope limitations in camp and picnic areas is not practical, and paths and trails should be placed on the contours as much as possible to minimize the slope limitations.

Interpretive Groups

Land capability classification: 7S

KaG--Kalkaska sand, 40 to 80 percent slopes

Setting

Landscape position: Very steep sideslopes.

Landform: Glacial lake Nippising shoreline.

Shape of areas: linear

Typical Profile

Surface layer:

0 to 2 inches--black partially decomposed leaf litter

Subsurface layer:

2 to 12 inches--pinkish gray sand

Subsoil:

12 to 19 inches--dark reddish brown sand

19 to 29 inches--strong brown sand

Substratum:

29 to 60 inches--light brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Somewhat excessively drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Medium

Flooding: None

Composition

Kalkaska soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Kalkaska soil with gentler slopes.

Similar inclusions:

Areas with lighter colored subsoils.

Areas where the substratum is gravelly sand.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture, steep slopes.

Management measures: Due to the steep slopes and sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Overcoming the slope limitations in camp and picnic areas is not practical, and paths and trails should be placed on the contours as much as possible to minimize the slope limitations.

Interpretive Groups

Land capability classification: 7S

KdB--Karlin sandy loam, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating upland flats.

Landform: Outwash terraces, ground moraines, end moraines.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 2 inches--black partially decomposed leaf litter

Subsurface layer:

2 to 6 inches--brown sandy loam

Subsoil:

6 to 9 inches--dark reddish brown sandy loam

9 to 19 inches--reddish brown sandy loam

19 to 24 inches--dark brown loamy sand

Substratum:

24 to 60 inches--brown sand

Soil Properties and Qualities

Depth class: Very deep
Permeability: Moderately rapid in the loamy horizons and rapid in the substratum.
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: >60 inches below the surface
Surface runoff: Slow
Flooding: None

Composition

Karlin soil and similar soils: 80 to 90 percent
 Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
 The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.
 Areas of the Karlin soil with steeper slopes.
Similar inclusions:
 Areas with a loamy layer in the substratum.
 Areas that lack the loamy surface layers.
 Areas with loamy very fine sand eolian surface layers in the area south of the Grand Sable Dunes.
 Areas with a buried spodic profile in the area south of the Grand Sable Dunes.
 Areas with mottling below 40 inches, loamy very fine sand eolian surface and a loamy layer in the substratum in the vicinity of Sable Falls.

Use and Management

Land use: Recreation
Major management concerns: None.
Management measures: This map unit has slight limitations for camp areas, picnic areas and paths and trails.

Interpretive Groups

Land capability classification: 3S

KdD--Karlin sandy loam, 6 to 18 percent slopes

Setting

Landscape position: Gently rolling to rolling sideslopes, knolls and ridges.
Landform: Outwash terraces, ground moraines, end moraines.
Shape of areas: Irregular

Typical Profile

Surface layer:
 0 to 2 inches--black partially decomposed leaf litter
Subsurface layer:
 2 to 6 inches--brown sandy loam
Subsoil:
 6 to 9 inches--dark reddish brown sandy loam
 9 to 19 inches--reddish brown sandy loam
 19 to 24 inches--dark brown loamy sand
Substratum:
 24 to 60 inches--brown sand

Soil Properties and Qualities

Depth class: Very deep
Permeability: Moderately rapid in the loamy horizons and rapid in the substratum.
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: >60 inches below the surface
Surface runoff: Slow
Flooding: None

Composition

Karlin soil and similar soils: 80 to 90 percent
 Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
 The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.
 Areas of the Karlin soil with gentler or steeper slopes.
Similar inclusions:
 Areas with a loamy layer in the substratum.

Areas with loamy very fine sand eolian surface layers in the area south of the Grand Sable Dunes.
 Areas with a buried spodic profile in the area south of the Grand Sable Dunes.
 Areas that lack the loamy surface layers.

Use and Management

Land use: Recreation

Major management concerns: Slope steepness.

Management measures: This map unit has moderate limitations for camp and picnic areas due to slope. Minor land shaping will be necessary to convert the site to those uses. The limitations are slight for paths and trails.

Interpretive Groups

Land capability classification: 3E

KdE--Karlín sandy loam, 18 to 40 percent slopes

Setting

Landscape position: Hilly to steep knolls, ridges and sideslopes.

Landform: Outwash terraces, ground moraines, end moraines.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 2 inches--black partially decomposed leaf litter

Subsurface layer:

2 to 6 inches--brown sandy loam

Subsoil:

6 to 9 inches--dark reddish brown sandy loam

9 to 19 inches--reddish brown sandy loam

19 to 24 inches--dark brown loamy sand

Substratum:

24 to 60 inches--brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderately rapid in the loamy horizons and rapid in the substratum.

Available water capacity: Moderate

Drainage class: Well drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Medium

Flooding: None

Composition

Karlín soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Karlín soil with gentler slopes.

Similar inclusions:

Areas with a loamy layer in the substratum.

Areas with loamy very fine sand eolian surface layers in the area south of the Grand Sable Dunes.

Areas with a buried spodic profile in the area south of the Grand Sable Dunes.

Areas that lack the loamy surface layers.

Use and Management

Land use: Recreation

Major management concerns: Slope steepness.

Management measures: Due to the steep slopes of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. Overcoming the slope limitations for camp and picnic areas is not practical, and paths and trails should be placed on the contours as much as possible to minimize the slope limitations.

Interpretive Groups

Land capability classification: 3E

KgC--Kawbawgam sandy loam, 0 to 10 percent slopes

Setting

Landscape position: Nearly level to rolling flats and depressions.

Landform: Sandstone bedrock benches.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 2 inches--dark reddish brown well decomposed leaf litter

Subsurface layer:

2 to 8 inches--brown sandy loam

Subsoil:

8 to 12 inches--mottled dark reddish brown sandy loam

12 to 20 inches--mottled brown sandy loam

Stratum:

20 to 26 inches--mottled brown sandy loam

26 inches--sandstone bedrock

Soil Properties and Qualities

Depth class: Moderately deep

Permeability: Moderate

Available water capacity: Low

Drainage class: Somewhat poorly drained

Seasonal high water table: 0.5 to 1.0 feet below the surface

Surface runoff: Slow

Flooding: None

Composition

Kawbawgam soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The poorly drained Jacobsville and Burt soils in drainageways and depressions.

The moderately well drained Onota and Munising soils in higher landscape positions.

Similar inclusions:

Areas with depths to bedrock less than 20 inches or greater than 40 inches.

Use and Management

Land use: Recreation

Major management concerns: Wetness.

Management measures: Due to the high water table of this map unit, the area has severe limitations for camp areas, picnic areas and paths and trails. Controlling access to camp and picnic areas during the periods in spring or fall when this soil is wet and protecting paths and trails with wood

chips or other suitable mulch material will minimize the wetness limitations. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 3W

KmB--Kalkaska-Munising complex, dissected, 1 to 12 percent slopes

Setting

Landscape position: Nearly level to moderately sloping dissected uplands.

Landform: Dissected water worked moraines, characterized by a series of parallel ridgetops and ravines with intermittent streams at the base of the ravines.

Shape of areas: Irregular

Typical Profile

Kalkaska

Surface layer:

0 to 2 inches--black partially decomposed leaf litter

Subsurface layer:

2 to 12 inches--pinkish gray sand

Subsoil:

12 to 19 inches--dark reddish brown sand

19 to 29 inches--strong brown sand

Stratum:

29 to 60 inches--light brown sand

Munising

Surface layer:

0 to 1 inch--black sandy loam

Subsurface layer:

1 to 6 inches--pinkish gray sandy loam

Subsoil:

6 to 13 inches--dark reddish brown sandy loam

13 to 16 inches--reddish brown sandy loam

16 to 46 inches--mixed, very firm light reddish brown loamy sand and reddish brown sandy loam

Substratum:

46 to 60 inches--reddish brown sandy loam

Soil Properties and Qualities

Depth class: Very deep

Permeability: Kalkaska--Rapid; Munising--Moderate in the upper part, very slow in the very firm subsoil layer, and moderate in the substratum

Available water capacity: Kalkaska--Low; Munising--Moderate

Drainage class: Kalkaska--Somewhat excessively drained; Munising--Moderately well drained

Seasonal high water table: Kalkaska-->60 inches below the surface; Munising--Perched, 1 to 2 feet below the surface

Surface runoff: Slow

Flooding: None

Composition

Kalkaska soil and similar soils: 45 to 60 percent

Munising soil and similar soils: 30 to 50 percent

Contrasting inclusions: 5 to 15 percent

Inclusions*Contrasting inclusions:*

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Similar inclusions:

Areas of the Munising soil with sandy layers overlying the very firm subsoil.

Areas of the Kalkaska soil with loamy bands in the subsoil.

Use and Management**Land use:** Recreation

Major management concerns: Wetness and slow percolation in the Munising soil. Sandy soil texture in the Kalkaska soil.

Management measures: Due to the sandy nature of the Kalkaska soil, the Kalkaska portion of this map unit has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems.

Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation. Due to the very firm subsoil layer of the Munising soil, this map unit has a perched water table on the Munising portion after snowmelt or excessively wet periods.

This results in moderate limitations due to wetness for paths and trails and picnic areas and severe limitations for camp areas. The slow percolation rate also contributes to the moderate limitations for picnic areas.

Controlling access to camp and picnic areas during the brief periods in spring or fall when this soil is wet will minimize these limitations. Protecting paths and trails with wood chips or other suitable mulch material can help minimize this limitation. In most years, the periods when the Munising soil is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: Munising--3E; Kalkaska--6S

KmD--Kalkaska-Munising complex, dissected, 8 to 35 percent slopes

Setting

Landscape position: Moderately sloping to steep dissected uplands.

Landform: Dissected water worked moraines, characterized by a series of parallel ridgetops and ravines with intermittent streams at the base of the ravines.

Shape of areas: Irregular

Typical Profile**Kalkaska***Surface layer:*

0 to 2 inches--black partially decomposed leaf litter

Subsurface layer:

2 to 12 inches--pinkish gray sand

Subsoil:

12 to 19 inches--dark reddish brown sand

19 to 29 inches--strong brown sand

Substratum:
29 to 60 inches--light brown sand

Munising

Surface layer:
0 to 1 inch--black sandy loam
Subsurface layer:
1 to 6 inches--pinkish gray sandy loam
Subsoil:
6 to 13 inches--dark reddish brown sandy loam
13 to 16 inches--reddish brown sandy loam
16 to 46 inches--mixed, very firm light reddish brown loamy sand and reddish brown sandy loam
Substratum:
46 to 60 inches--reddish brown sandy loam

Soil Properties and Qualities

Depth class: Very deep
Permeability: Kalkaska--Rapid; Munising--Moderate in the upper part, very slow in the very firm subsoil layer, and moderate in the substratum
Available water capacity: Kalkaska--Low; Munising--Moderate
Drainage class: Kalkaska--Somewhat excessively drained; Munising--Well drained
Seasonal high water table: >60 inches below the surface
Surface runoff: Medium on the sides of the ravines, slow on the flatter areas between the ravines
Flooding: None

Composition

Kalkaska soil and similar soils: 45 to 60 percent
Munising soil and similar soils: 30 to 50 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.
Similar inclusions:
Areas of the Munising soil with sandy layers overlying the very firm subsoil.

Areas of the Kalkaska soil with loamy bands in the subsoil.

Use and Management

Land use: Recreation
Major management concerns: Slope steepness on both soils, sandy soil texture in the Kalkaska soil.
Management measures: Due to the steep slopes of both soils and the sandy nature of the Kalkaska soil, this map unit has severe limitations for camp areas and picnic areas. The Kalkaska portion of this map unit has severe limitations for paths and trails, and the Munising portion has moderate limitations. The Kalkaska soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation. Overcoming the slope limitations in camp and picnic areas is not practical, and paths and trails should be placed on the contours as much as possible to minimize the slope limitations.

Interpretive Groups

Land capability classification: Munising--6E; Kalkaska--7S

KmE--Kalkaska-Munising complex, dissected, 15 to 60 percent slopes

Setting

Landscape position: Strongly sloping to very steep dissected uplands.
Landform: Dissected water worked moraines, characterized by a series of parallel ridgetops and ravines with intermittent streams at the base of the ravines.
Shape of areas: Irregular

Typical Profile

Kalkaska

Surface layer:
0 to 2 inches--black partially decomposed leaf litter
Subsurface layer:
2 to 12 inches--pinkish gray sand

Subsoil:

12 to 19 inches--dark reddish brown sand

19 to 29 inches--strong brown sand

Substratum:

29 to 60 inches--light brown sand

Munising**Surface layer:**

0 to 1 inch--black sandy loam

Subsurface layer:

1 to 6 inches--pinkish gray sandy loam

Subsoil:

6 to 13 inches--dark reddish brown sandy loam

13 to 16 inches--reddish brown sandy loam

16 to 46 inches--mixed, very firm light reddish brown loamy sand and reddish brown sandy loam

Substratum:

46 to 60 inches--reddish brown sandy loam

Soil Properties and Qualities

Depth class: Very deep

Permeability: Kalkaska--Rapid; Munising--Moderate in the upper part, very slow in the very firm subsoil layer, and moderate in the substratum

Available water capacity: Kalkaska--Low; Munising--Moderate

Drainage class: Kalkaska--Somewhat excessively drained; Munising--Well drained
Seasonal high water table: >60 inches below the surface

Surface runoff: Medium

Flooding: None

Composition

Kalkaska soil and similar soils: 45 to 60 percent

Munising soil and similar soils: 30 to 50 percent

Contrasting inclusions: 5 to 15 percent

Inclusions**Contrasting inclusions:**

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Similar inclusions:

Areas of the Munising soil with sandy layers overlying the very firm subsoil.

Areas of the Kalkaska soil with loamy bands in the subsoil.

Use and Management**Land use:** Recreation

Major management concerns: Slope steepness on both soils, sandy soil texture in the Kalkaska soil.

Management measures: Due to the steep slopes of both soils and the sandy nature of the Kalkaska soil, this map unit has severe limitations for camp areas, picnic areas and paths and trails. The Kalkaska soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Overcoming the slope limitations in camp and picnic areas is not practical, and paths and trails should be placed on the contours as much as possible to minimize the slope limitations.

Interpretive Groups

Land capability classification: Munising--7E; Kalkaska--7S

KnB--Keweenaw loamy sand, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating upland flats.

Landform: Ground moraines.

Shape of areas: Irregular

Typical Profile**Surface layer:**

0 to 1 inch--black loamy sand

Subsurface layer:

1 to 8 inches--reddish gray loamy sand

Subsoil:

8 to 13 inches--dark reddish brown loamy sand

13 to 29 inches--reddish brown loamy sand

29 to 32 inches--yellowish red sand

32 to 39 inches--mixed reddish brown fine sandy loam and weak red loamy sand

Substratum:

39 to 60 inches--reddish brown loamy sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderately rapid.

Available water capacity: Low

Drainage class: Well drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Slow

Flooding: None

Composition

Keweenaw soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Keweenaw soil with steeper slopes.

Similar inclusions:

Areas with a firm loamy layer in the subsoil.

Areas that lack the loamy subsoil layers.

Areas with sandier textures in the surface, subsurface and substratum layers.

Use and Management

Land use: Recreation

Major management concerns: None.

Management measures: This map unit has slight limitations for camp areas, picnic areas and paths and trails.

Interpretive Groups

Land capability classification: 3E

KnD--Keweenaw loamy sand, 6 to 18 percent slopes

Setting

Landscape position: Gently rolling to rolling sideslopes, knolls and ridges.

Landform: Ground moraines.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 1 inch--black loamy sand

Subsurface layer:

1 to 8 inches--reddish gray loamy sand

Subsoil:

8 to 13 inches--dark reddish brown loamy sand

13 to 29 inches--reddish brown loamy sand

29 to 32 inches--yellowish red sand

32 to 39 inches--mixed reddish brown fine sandy loam and weak red loamy sand

Substratum:

39 to 60 inches--reddish brown loamy sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderately rapid.

Available water capacity: Low

Drainage class: Well drained

Seasonal high water table: >60 inches below the surface

Surface runoff: Slow

Flooding: None

Composition

Keweenaw soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Keweenaw soil with gentler or steeper slopes.

Similar inclusions:

Areas with a firm loamy layer in the subsoil.

Areas that lack the loamy subsoil layers.

Areas with sandier textures in the surface, subsurface and substratum layers.

Use and Management

Land use: Recreation

Major management concerns: Slope steepness.

Management measures: This map unit has moderate limitations for camp and picnic areas due to slope. Minor land shaping will be necessary to convert the site to those uses. The limitations are slight for paths and trails.

Interpretive Groups

Land capability classification: 4E

Kr--Kinross mucky sand

Setting

Landscape position: Level low lying flats and depressions.

Landform: Outwash plains, lake plains and till plains.

Shape of areas: Irregular, circular or linear

Typical Profile

Surface layer:

0 to 6 inches--black muck

Subsurface layer:

6 to 10 inches--mottled grayish brown sand

Subsoil:

10 to 24 inches--mottled dark reddish brown sand

24 to 42 inches--dark brown sand

Substratum:

42 to 60 inches--brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Poorly drained

Seasonal high water table: 1 foot above to 1 foot below the surface

Surface runoff: Very slow or ponded

Flooding: None

Composition

Kinross soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

Areas of the somewhat poorly drained Au Gres soils in slightly higher landscape positions.

Areas of the very poorly drained Dawson soil in similar landscape positions.

Similar inclusions:

Areas with lighter colored subsoil layers.

Use and Management

Land use: Recreation

Major management concerns: Ponding.

Management measures: Due to the ponding of surface water on this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: 6W

Lb--Lake Beaches

Setting

Landscape position: Nearly level flat areas.

Landform: Beaches adjacent to Lake Superior.

Shape of areas: Narrow and linear.

Typical Profile

This miscellaneous area occupies narrow beaches along the shore of Lake Superior, mainly in the Twelvemile Beach area. This map unit is mainly sandy, cobbly or gravelly in texture, but there some areas of exposed sandstone bedrock in the vicinity of Point Au Sable.

Soil Properties and Qualities

Depth class: Variable
Permeability: Variable
Available water capacity: Variable
Drainage class: Variable
Seasonal high water table: Variable
Surface runoff: Variable
Flooding: None

Use and Management

Land use: Not rated for any uses.
Major management concerns: Not rated.

Interpretive Groups

Land capability classification: Not rated

McB--Mancelona loamy sand, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating upland flats.
Landform: Vegetated former outwash channels in the Grand Sable Dunes.
Shape of areas: Irregular

Typical Profile

Surface layer:
 0 to 2 inches--black organic matter
Subsurface layer:
 2 to 8 inches--brown loamy sand
Subsoil:
 8 to 17 inches--dark brown loamy sand
 17 to 22 inches--strong brown loamy sand
 22 to 26 inches--reddish brown gravelly clay loam
Substratum:
 26 to 60 inches--brown stratified sand and gravel.

Soil Properties and Qualities

Depth class: Very deep
Permeability: Moderately rapid in the upper part and very rapid in the substratum.
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: >60 inches below the surface
Surface runoff: Slow

Flooding: None

Composition

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

Inclusions

Contrasting inclusions:
 Areas of the Duneland miscellaneous area around the edges of the map unit.
Similar inclusions:
 Areas with less clay in the loamy subsoil layers.
 Areas with sandier textures in the substratum layers.

Use and Management

Land use: Recreation
Major management concerns: None.
Management measures: This map unit has slight limitations for camp areas, picnic areas and paths and trails.

Interpretive Groups

Land capability classification: 3S

Mh--Marsh**Setting**

Landscape position: Low lying areas permanently inundated with water.
Landform: Outwash plains, ground moraines.
Shape of areas: Irregular or narrow and linear.

Typical Profile

This miscellaneous area occupies low lying depressional areas that are permanently inundated with water. They are characterized by emergent aquatic vegetation and are extremely variable in soil texture and depth and duration of inundation.

Soil Properties and Qualities

Depth class: Variable
Permeability: Variable
Available water capacity: Variable
Drainage class: Very poorly drained

Seasonal high water table: Variable
Surface runoff: Ponded
Flooding: None

Use and Management

Land use: Not rated for any uses.
Major management concerns: Not rated.

Interpretive Groups

Land capability classification: Not rated

MuB--Munising sandy loam, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating upland flats.
Landform: Ground moraines.
Shape of areas: Irregular

Typical Profile

Surface layer:
 0 to 1 inch--black sandy loam
Subsurface layer:
 1 to 6 inches--pinkish gray sandy loam
Subsoil:
 6 to 13 inches--dark reddish brown sandy loam
 13 to 16 inches--reddish brown sandy loam
 16 to 46 inches--mixed, very firm light reddish brown loamy sand and reddish brown sandy loam
Substratum:
 46 to 60 inches--reddish brown sandy loam

Soil Properties and Qualities

Depth class: Very deep
Permeability: Moderate in the upper part, very slow in the very firm subsoil layer, and moderate in the substratum
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Perched, 1 to 2 feet below the surface
Surface runoff: Slow
Flooding: None

Composition

Munising soil and similar soils: 80 to 90 percent
 Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Skanee soils and the poorly drained Ensley and Angelica soils in depressions and drainageways. Areas of the Munising soil with steeper slopes.

Similar inclusions:

Areas with sandy layers overlying the very firm subsoil.
 Areas where the substratum is sand.
 Areas with bedrock within 40 inches.
 Areas that lack the very firm subsoil.

Use and Management

Land use: Recreation

Major management concerns: Wetness, slow percolation.

Management measures: Due to the very firm subsoil layer, this map unit has a perched water table after snowmelt or excessively wet periods. This results in moderate limitations due to wetness for paths and trails and picnic areas and severe limitations for camp areas. The slow percolation rate also contributes to the moderate limitations for picnic areas. Controlling access to camp and picnic areas during the brief periods in spring or fall when this soil is wet will minimize these limitations. Protecting paths and trails with wood chips or other suitable mulch material can help minimize this limitation. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 2E

MuD--Munising sandy loam, 6 to 18 percent slopes**Setting**

Landscape position: Gently rolling to rolling sideslopes, knolls and ridges.

Landform: Ground moraines.

Shape of areas: Irregular

Typical Profile*Surface layer:*

0 to 1 inch--black sandy loam

Subsurface layer:

1 to 6 inches--pinkish gray sandy loam

Subsoil:

6 to 13 inches--dark reddish brown sandy loam

13 to 16 inches--reddish brown sandy loam

16 to 46 inches--mixed, very firm light reddish brown loamy sand and reddish brown sandy loam

Substratum:

46 to 60 inches--reddish brown sandy loam

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderate in the upper part, very slow in the very firm subsoil layer, and moderate in the substratum

Available water capacity: Moderate

Drainage class: Moderately well drained

Seasonal high water table: Perched, 1 to 2 feet below the surface

Surface runoff: Slow

Flooding: None

Composition

Munising soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions*Contrasting inclusions:*

The somewhat poorly drained Skanee soils and the poorly drained Ensley and Angelica soils in depressions and drainageways.

Areas of the Munising soil with gentler or steeper slopes.

Similar inclusions:

Areas with sandy layers overlying the very firm subsoil.

Areas where the substratum is sand.

Areas with bedrock within 40 inches.

Areas that lack the very firm subsoil.

Use and Management

Land use: Recreation

Major management concerns: Wetness, slope, slow percolation.

Management measures: Due to the very firm subsoil layer, this map unit has a perched water table after snowmelt or excessively wet periods. This results in moderate limitations due to wetness for paths and trails and picnic areas and severe limitations for camp areas. The slope steepness and slow percolation rate also contributes to the moderate limitations for picnic areas.

Controlling access to camp and picnic areas during the brief periods in spring or fall when this soil is wet will minimize these limitations. Protecting paths and trails with wood chips or other suitable mulch material can help minimize this limitation. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 3E

MuE--Munising sandy loam, 18 to 40 percent slopes**Setting**

Landscape position: Hilly to steep knolls, ridges and sideslopes.

Landform: Moraines.

Shape of areas: Irregular

Typical Profile*Surface layer:*

0 to 1 inch--black sandy loam

Subsurface layer:

1 to 6 inches--pinkish gray sandy loam

Subsoil:

6 to 13 inches--dark reddish brown sandy loam

13 to 16 inches--reddish brown sandy loam

16 to 46 inches--mixed, very firm light reddish brown loamy sand and reddish brown sandy loam

Substratum:

46 to 60 inches--reddish brown sandy loam

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderate in the upper part, very slow in the very firm subsoil layer, and moderate in the substratum

Available water capacity: Moderate

Drainage class: Well drained

Seasonal high water table: > 60 inches below the surface

Surface runoff: Medium

Flooding: None

Composition

Munising soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Skanee soils and the poorly drained Ensley and Angelica soils in depressions and drainageways.

Areas of the Munising soil with gentler slopes.

Similar inclusions:

Areas with sandy layers overlying the very firm subsoil.

Areas where the substratum is sand.

Areas with bedrock within 40 inches.

Areas that lack the very firm subsoil.

Use and Management

Land use: Recreation

Major management concerns: Slope steepness.

Management measures: Due to the steep slopes of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. Overcoming the slope limitations for camp and picnic areas is not practical, and paths and trails should be placed on the contours as much as possible to minimize the slope limitations.

Interpretive Groups

Land capability classification: 7E

Nh--Nahma muck

Setting

Landscape position: Level depressional areas.

Landform: Sandstone benches and till plains.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 4 inches--black muck

4 to 9 inches--black loam

Subsurface layer:

9 to 13 inches--mottled gray loam

Subsoil:

13 to 19 inches--mottled brown fine sandy loam

19 to 29 inches--mottled pale brown loam

Substratum:

29 to 33 inches--mottled light greenish gray loam

33 inches--sandstone bedrock (This series typically is underlain by limestone bedrock.)

Soil Properties and Qualities

Depth class: Moderately deep

Permeability: Moderate

Available water capacity: Moderate

Drainage class: Poorly drained

Seasonal high water table: 1 foot above to 1 foot below the surface

Surface runoff: Very slow or ponded

Flooding: None

Composition

Nahma soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

Areas of the somewhat poorly drained Kawbawgam and Sundell soils in slightly higher landscape positions.

Similar inclusions:

Areas with depths to bedrock greater than 40 inches or less than 20 inches.

Areas with greater than 16 inches of muck on the surface.

Areas with sandier textured profiles.

Use and Management

Land use: Recreation

Major management concerns: Ponding, excess humus.

Management measures: Due to the ponding of surface water and the muck surface layer of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: TW

OoE--Onota-Chippeny complex, 0 to 35 percent slopes

Setting

Landscape position: Level to steep depressions, sideslopes, knolls and ridges.

Landform: Sandstone benches and bedrock controlled till plains.

Shape of areas: Irregular

Typical Profile**Onota**

Surface layer:

0 to 3 inches--very dark gray sandy loam

Subsurface layer:

3 to 7 inches--grayish brown sandy loam

Subsoil:

7 to 10 inches--dark reddish brown sandy loam

10 to 24 inches--reddish brown sandy loam

Substratum:

24 to 28 inches--reddish brown loamy sand

28 to 31 inches--dark yellowish brown and brown highly weathered sandstone

31 inches--sandstone bedrock

Chippeny

Surface layer:

0 to 6 inches--black muck

Subsurface layer:

6 to 20 inches--very dark gray muck

Substratum:

20 to 28 inches--dark grayish brown silty clay loam

28 inches--sandstone bedrock (This series typically is underlain by limestone bedrock.)

Soil Properties and Qualities

Depth class: Onota--moderately deep;

Chippeny--deep

Permeability: Onota--moderate; Chippeny--moderately slow

Available water capacity: Onota--moderate; Chippeny--high

Drainage class: Onota--well drained;

Chippeny--very poorly drained

Seasonal high water table: Onota--briefly perched on bedrock following snowmelt; Chippeny--1 foot above to 1 foot below the surface.

Surface runoff: Onota--medium; Chippeny--very slow or ponded

Flooding: None

Composition

Onota soil and similar soils: 30 to 50 percent

Chippeny soil and similar soils: 20 to 40 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Kawbawgam and the poorly drained Burt soils in depressions and drainageways.

Areas of both soils with steeper slopes.

Areas of sandstone bedrock outcroppings.

Similar inclusions:

Areas where the bedrock is deeper than 51 inches or shallower than 20 inches.

Areas in the vicinity of Chapel Lake with a loamy very fine sand eolian cap.

Use and Management

Land use: Recreation

Major management concerns: Ponding, excess humus, slope steepness.

Management measures: Due to the slope steepness of the Onota soil and the ponding of surface water and organic surface layer of the Chippeny soil, the entire map unit has severe limitations for camp and picnic areas and paths and trails. Overcoming the limitations for camp and picnic areas is not practical, and paths and trails on the Onota soil should be placed on the contours as much as possible to minimize the slope limitations. Paths or trails that cross the Chippeny soil must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: Onota--7E; Chippeny--7W

OrB--Onota-Deerton complex, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating upland flats.

Landform: Sandstone benches and bedrock controlled till plains.

Shape of areas: Irregular

Typical Profile

Onota

Surface layer:

0 to 3 inches--very dark gray sandy loam

Subsurface layer:

3 to 7 inches--grayish brown sandy loam

Subsoil:

7 to 10 inches--dark reddish brown sandy loam

10 to 24 inches--reddish brown sandy loam

Substratum:

24 to 28 inches--reddish brown loamy sand

28 to 31 inches--dark yellowish brown and brown highly weathered sandstone

31 inches--sandstone bedrock

Deerton

Surface layer:

0 to 1 inch--black organic matter and very dark gray sand

Subsurface layer:

1 to 8 inches--pinkish gray sand

Subsoil:

8 to 9 inches--dark reddish brown loamy sand

9 to 24 inches--reddish brown sand

Substratum:

24 to 38 inches--dark yellowish brown and very pale brown highly weathered sandstone

38 inches--sandstone bedrock

Soil Properties and Qualities

Depth class: Moderately deep

Permeability: Onota--moderate; Deerton--rapid

Available water capacity: Onota--moderate; Deerton--low

Drainage class: Onota--well drained; Deerton--somewhat excessively drained

Seasonal high water table: Briefly perched on bedrock following snowmelt.

Surface runoff: Slow

Flooding: None

Composition

Onota soil and similar soils: 50 to 70 percent

Deerton soil and similar soils: 30 to 45 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Kawbawgam and the poorly drained Burt soils in depressions and drainageways.

Areas of both soils with steeper slopes.

Similar inclusions:

Areas where the bedrock is deeper or shallower.

Areas in the vicinity of Chapel Lake with a loamy very fine sand eolian cap.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture.

Management measures: Due to the sandy nature of the Deerton soil, the Deerton portion of this map unit has moderate limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation. The Onota portion of this map unit has slight limitations for camp and picnic areas and paths and trails.

Interpretive Groups

Land capability classification: Onota--3E; Deerton--4S

OrD--Onota-Deerton complex, 6 to 18 percent slopes

Setting

Landscape position: Gently rolling to rolling sideslopes, knolls and ridges.

Landform: Sandstone benches and bedrock controlled till plains.

Shape of areas: Irregular

Typical Profile

Onota

Surface layer:

0 to 3 inches--very dark gray sandy loam

Subsurface layer:

3 to 7 inches--grayish brown sandy loam

Subsoil:

7 to 10 inches--dark reddish brown sandy loam

10 to 24 inches--reddish brown sandy loam

Stratum:

24 to 28 inches--reddish brown loamy sand

28 to 31 inches--dark yellowish brown and brown highly weathered sandstone

31 inches--sandstone bedrock

Deerton

Surface layer:

0 to 1 inch--black organic matter and very dark gray sand

Subsurface layer:

1 to 8 inches--pinkish gray sand

Subsoil:

8 to 9 inches--dark reddish brown loamy sand

9 to 24 inches--reddish brown sand

Stratum:

24 to 38 inches--dark yellowish brown and very pale brown highly weathered sandstone
38 inches--sandstone bedrock

Soil Properties and Qualities

Depth class: Moderately deep

Permeability: Onota--moderate; Deerton--rapid

Available water capacity: Onota--moderate; Deerton--low

Drainage class: Onota--well drained; Deerton--somewhat excessively drained

Seasonal high water table: Briefly perched on bedrock following snowmelt.

Surface runoff: Slow

Flooding: None

Composition

Onota soil and similar soils: 50 to 70 percent

Deerton soil and similar soils: 30 to 45 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Kawbawgam and the poorly drained Burt soils in depressions and drainageways.

Areas of both soils with gentler slopes.

Similar inclusions:

Areas where the bedrock is deeper than 40 inches or shallower than 20 inches.

Areas in the vicinity of Chapel Lake with a loamy very fine sand eolian cap.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture, slope.

Management measures: Due to the slope steepness and sandy nature of the Deerton soil, the entire map unit has moderate limitations for camp areas and picnic areas. The Deerton portion of this map unit has moderate limitations for paths and trails, due to sandy texture, and the Onota soil has slight limitations for paths and trails. The Deerton soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation. Minor land shaping will be necessary to convert the site to camp or picnic areas, and the depth to bedrock could make this impractical.

Interpretive Groups

Land capability classification: Onota--6E; Deerton--6S

OtB--Otisco loamy sand, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating flats and depressions.

Landform: Ground moraines.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 7 inches--black loamy sand

Subsurface layer:

7 to 9 inches--grayish brown sand

Subsoil:

9 to 17 inches--mottled dark brown sand

17 to 24 inches--mottled brown sand

24 to 29 inches--mottled, mixed brown sand and reddish brown loamy sand

29 to 41 inches--reddish brown loamy sand and very fine sandy loam

Stratum:

41 to 60 inches--light reddish brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Somewhat poorly drained

Seasonal high water table: 0.5 to 1.5 feet below the surface

Surface runoff: Slow

Flooding: None

Composition

Sundell soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The poorly drained Roscommon soils in drainageways and depressions.

The well drained Blue Lake soils in higher landscape positions.

Similar inclusions:

Areas that lack the loamy subsoil horizons.

Use and Management

Land use: Recreation

Major management concerns: Wetness.

Management measures: Due to the high water table of this map unit, the area has severe limitations for camp areas, picnic areas and paths and trails. Controlling access to camp and picnic areas during the periods in spring or fall when this soil is wet and protecting paths and trails with wood chips or other suitable mulch material will minimize the wetness limitations. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 3W

Rc--Roscommon mucky sand**Setting**

Landscape position: Level low lying flats and depressions.

Landform: Outwash plains, lake plains and till plains.

Shape of areas: Irregular or linear

Typical Profile*Surface layer:*

0 to 4 inches--black muck

Subsurface layer:

4 to 6 inches--dark gray sand

Subsoil:

6 to 10 inches--grayish brown sand

Substratum:

10 to 60 inches--dark grayish brown and grayish brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid.

Available water capacity: Low.

Drainage class: Poorly drained

Seasonal high water table: 1 foot above to 1 foot below the surface

Surface runoff: Very slow or ponded

Flooding: None

Composition

Roscommon soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions*Contrasting inclusions:*

Areas of the somewhat poorly drained Au Gres soils in slightly higher landscape positions.

Areas of the very poorly drained Tawas soil in similar landscape positions.

Similar inclusions:

Areas with a mucky loamy sand surface layer.

Areas in the vicinity of Grand Marais with a mucky loamy very fine sand eolian surface layer.

Use and Management**Land use:** Recreation

Major management concerns: Ponding.

Management measures: Due to the ponding of surface water on this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups

Land capability classification: 6W

RkB--Roscommon-Kalkaska complex, 0 to 6 percent slopes**Setting**

Landscape position: Level to undulating upland flats and depressions.

Landform: Outwash plains, lake plains and till plains.

Shape of areas: Irregular or linear

Typical Profile**Roscommon***Surface layer:*

0 to 4 inches--black muck

Subsurface layer:

4 to 6 inches--dark gray sand

Subsoil:

6 to 10 inches--grayish brown sand

Substratum:

10 to 60 inches--dark grayish brown and grayish brown sand

Kalkaska*Surface layer:*

0 to 2 inches--black partially decomposed leaf litter

Subsurface layer:

2 to 12 inches--pinkish gray sand

Subsoil:

12 to 19 inches--dark reddish brown sand

19 to 29 inches--strong brown sand

Substratum:

29 to 60 inches--light brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Kalkaska--somewhat excessively drained; Roscommon--poorly drained

Seasonal high water table: Kalkaska-->60 inches below the surface; Roscommon--1 foot above to 1 foot below the surface

Surface runoff: Kalkaska--slow; Roscommon--Very slow or ponded

Flooding: None

Composition

Roscommon soil and similar soils: 40 to 60 percent

Kalkaska soil and similar soils: 25 to 45 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

Areas of the somewhat poorly drained Au Gres soils in slightly higher landscape positions than the Roscommon soil.

Areas of the very poorly drained Tawas soil in slightly lower landscape positions than the Roscommon soil.

Similar inclusions:

Areas with a mucky loamy sand surface layer on the Roscommon soil.

Areas of both soils with gravelly substratums.

Use and Management

Land use: Recreation

Major management concerns: Ponding, sandy soil texture.

Management measures: Due to the ponding of surface water on the Roscommon soil and the sandy texture of the Kalkaska soil, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations of the Roscommon soil are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross the Roscommon soil must be elevated with a boardwalk or similar

structure to minimize the limitations. The Kalkaska soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Interpretive Groups

Land capability classification: Roscommon--6W; Kalkaska--4S

RuB--Rubicon sand, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating upland flats.

Landform: Outwash plains and stream terraces.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 1 inch--black sand

Subsurface layer:

1 to 4 inches--brown sand

Subsoil:

4 to 8 inches--reddish brown sand

8 to 27 inches--brown sand

Substratum:

27 to 60 inches--light brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Excessively

Seasonal high water table: >60 inches below the surface

Surface runoff: Very slow

Flooding: None

Composition

Rubicon soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions*Contrasting inclusions:*

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Similar inclusions:

Areas that are mottled below 40 inches.
Areas with darker subsoils.
Areas where the substratum is gravelly sand.

Use and Management**Land use:** Recreation

Major management concerns: Sandy soil texture

Management measures: Due to the sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Interpretive Groups

Land capability classification: 6S

RuD--Rubicon sand, 6 to 18 percent slopes**Setting**

Landscape position: Gently rolling to rolling knolls, ridges and sideslopes.

Landform: Pitted outwash plains and stream terraces.

Shape of areas: Irregular or linear

Typical Profile*Surface layer:*

0 to 1 inch--black sand

Subsurface layer:

1 to 4 inches--brown sand

Subsoil:

4 to 8 inches--reddish brown sand

8 to 27 inches--brown sand

Substratum:

27 to 60 inches--light brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Excessively

Seasonal high water table: >60 inches below the surface

Surface runoff: Slow

Flooding: None

Composition

Rubicon soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions*Contrasting inclusions:*

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Rubicon soil with steeper or gentler slopes.

Similar inclusions:

Areas with darker subsoils.

Areas where the substratum is gravelly sand.

Use and Management**Land use:** Recreation

Major management concerns: Sandy soil texture

Management measures: Due to the sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Interpretive Groups

Land capability classification: 6S

RuE--Rubicon sand, 18 to 40 percent slopes

Setting

Landscape position: Hilly to steep ridges and sideslopes.

Landform: Outwash plains, stream terraces, glacial lake shorelines.

Shape of areas: Irregular or linear

Typical Profile

Surface layer:

0 to 1 inch--black sand

Subsurface layer:

1 to 4 inches--brown sand

Subsoil:

4 to 8 inches--reddish brown sand

8 to 27 inches--brown sand

Substratum:

27 to 60 inches--light brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Excessively

Seasonal high water table: >60 inches below the surface

Surface runoff: Slow

Flooding: None

Composition

Rubicon soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in depressions and drainageways.

Areas of the Rubicon soil with gentler slopes.

Similar inclusions:

Areas with darker subsoils.

Areas where the substratum is gravelly sand.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture, steep slopes.

Management measures: Due to the steep slopes and sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Overcoming the slope limitations in camp and picnic areas is not practical, and paths and trails should be placed on the contours as much as possible to minimize the slope limitations.

Interpretive Groups

Land capability classification: 7S

ShB--Sheldrake sand, 0 to 8 percent slopes

Setting

Landscape position: Level to gently rolling low beach ridges.

Landform: Ridge-swale beach ridge complex adjacent to Lake Superior (Also found on the lee side of the Grand Sable Dunes).

Shape of areas: Narrow and linear

Typical Profile

Surface layer:

0 to 1 inch--black and light brownish gray sand

Subsurface layer:

1 to 7 inches--light brownish gray sand

Subsoil:

7 to 18 inches--light yellowish brown sand

Substratum:

18 to 60 inches--pale brown and white sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Very rapid

Available water capacity: Very low

Drainage class: Excessively

Seasonal high water table: >60 inches below the surface

Surface runoff: Very slow

Flooding: None

Composition

Rubicon soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils in low lying swales.

Similar inclusions:

Areas that are mottled below 40 inches.

Areas with darker subsoils.

Areas with loamy subsoil layers in protected coves in the Grand Sable Dunes.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture

Management measures: Due to the sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Interpretive Groups

Land capability classification: 6S

SkB--Skanee sandy loam, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating depressions.

Landform: Ground moraines.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 3 inches--black partially decomposed organic matter

Subsurface layer:

3 to 8 inches--pinkish gray sandy loam

Subsoil:

8 to 17 inches--mottled dark reddish brown fine sandy loam

17 to 21 inches--mottled, very firm reddish brown sandy loam

21 to 36 inches--mottled, very firm, mixed weak red loamy sand and reddish brown sandy loam

Substratum:

36 to 60 inches--light reddish brown and reddish brown sandy loam

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderate in the upper part, very slow in the very firm subsoil layer, and moderate in the substratum

Available water capacity: Moderate

Drainage class: Somewhat poorly drained

Seasonal high water table: Perched, 0.5 to 1.5 feet below the surface

Surface runoff: Slow

Flooding: None

Composition

Skanee soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The moderately well drained Munising soils in slightly higher landscape positions.

Similar inclusions:

Areas that are deep to bedrock.

Use and Management

Land use: Recreation

Major management concerns: Wetness, slow percolation.

Management measures: Due to the very firm subsoil layer, this map unit has a perched water table after snowmelt or excessively

wet periods. This results in severe limitations due to wetness for paths and trails and camp and picnic areas. The slow percolation rate also contributes to the severe limitations for camp and picnic areas. Controlling access to camp and picnic areas during the periods in spring or fall when this soil is wet will minimize these limitations. Protecting paths and trails with wood chips or other suitable mulch material can help minimize this limitation. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 2W

StB—Steuben sandy loam, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating upland flats.

Landform: Water worked moraines and till plains.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 2 inches--black partially decomposed organic matter

Subsurface layer:

2 to 8 inches--reddish gray fine sandy loam

Subsoil:

8 to 16 inches--dark reddish brown fine sandy loam

13 to 16 inches--reddish brown sandy loam

16 to 21 inches--dark brown fine sandy loam

21 to 40 inches--mixed, very firm pinkish gray loamy fine sand and reddish brown fine sandy loam

Substratum:

40 to 60 inches--light brown and brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderate in the upper part, very slow in the very firm subsoil layer, and rapid in the substratum

Available water capacity: Moderate

Drainage class: Moderately well drained
Seasonal high water table: Perched, 1 to 2.5 feet below the surface
Surface runoff: Slow
Flooding: None

Composition

Steuben soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Skanee soils in depressions .

Areas of the Steuben soil with steeper slopes.

Similar inclusions:

Areas that are sandy throughout the profile.

Areas where the substratum is loamy.

Areas that lack the very firm subsoil.

Use and Management

Land use: Recreation

Major management concerns: Wetness, slow percolation.

Management measures: Due to the very firm subsoil layer, this map unit has a perched water table after snowmelt or excessively wet periods. This results in moderate limitations due to wetness for paths and trails and picnic areas and severe limitations for camp areas. The slow percolation rate also contributes to the moderate limitations for picnic areas. Controlling access to camp and picnic areas during the brief periods in spring or fall when this soil is wet will minimize these limitations. Protecting paths and trails with wood chips or other suitable mulch material can help minimize this limitation. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 2E

StD--Steuben sandy loam, 6 to 18 percent slopes**Setting**

Landscape position: Gently rolling to rolling sideslopes, knolls and ridges.

Landform: Water worked moraines.

Shape of areas: Irregular

Typical Profile*Surface layer:*

0 to 2 inches--black partially decomposed organic matter

Subsurface layer:

2 to 8 inches--reddish gray fine sandy loam

Subsoil:

8 to 16 inches--dark reddish brown fine sandy loam

13 to 16 inches--reddish brown sandy loam

16 to 21 inches--dark brown fine sandy loam

21 to 40 inches--mixed, very firm pinkish gray loamy fine sand and reddish brown fine sandy loam

Substratum:

40 to 60 inches--light brown and brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderate in the upper part, very slow in the very firm subsoil layer, and rapid in the substratum

Available water capacity: Moderate

Drainage class: Moderately well drained

Seasonal high water table: Perched, 1 to 2.5 feet below the surface

Surface runoff: Slow

Flooding: None

Composition

Steuben soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Skanee soils in depressions.

Areas of the Steuben soil with gentler slopes.

Similar inclusions:

Areas that are sandy throughout the profile.

Areas where the substratum is loamy.

Areas that lack the very firm subsoil.

Use and Management

Land use: Recreation

Major management concerns: Wetness, slope, slow percolation.

Management measures: Due to the very firm subsoil layer, this map unit has a perched water table after snowmelt or excessively wet periods. This results in moderate limitations due to wetness for paths and trails and picnic areas and severe limitations for camp areas. The slope steepness and slow percolation rate also contributes to the moderate limitations for picnic areas.

Controlling access to camp and picnic areas during the brief periods in spring or fall when this soil is wet will minimize these limitations. Protecting paths and trails with wood chips or other suitable mulch material can help minimize this limitation. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 3E

SvA--Sundell fine sandy loam, 0 to 4 percent slopes**Setting**

Landscape position: Nearly level to undulating flats and depressions.

Landform: Shallow till plains or sandstone bedrock benches.

Shape of areas: Irregular

Typical Profile*Surface layer:*

0 to 8 inches--very dark gray fine sandy loam

Subsoil:

8 to 17 inches--yellowish red loam

17 to 23 inches--mottled reddish brown loam

Substratum:

23 to 26 inches--light brown loam

26 inches--sandstone bedrock (Limestone bedrock is typical of the Sundell series, but

the entire survey area is underlain by sandstone bedrock)

Soil Properties and Qualities

Depth class: Moderately deep
Permeability: Moderate
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: 0.5 to 1.5 feet below the surface
Surface runoff: Slow
Flooding: None

Composition

Sundell soil and similar soils: 80 to 90 percent
 Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
 The poorly drained Nahma soils in drainageways and depressions.
Similar inclusions:
 Areas with depths to bedrock less than 20 inches or greater than 40 inches.

Use and Management

Land use: Recreation
Major management concerns: Wetness.
Management measures: Due to the high water table of this map unit, the area has severe limitations for camp areas, picnic areas and paths and trails. Controlling access to camp and picnic areas during the periods in spring or fall when this soil is wet and protecting paths and trails with wood chips or other suitable mulch material will minimize the wetness limitations. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 3W

SwA--Sundell loamy fine sand, Sandy Variant, 0 to 4 percent slopes

Setting

Landscape position: Nearly level to undulating flats and depressions.
Landform: Shallow till plains or sandstone bedrock benches.
Shape of areas: Irregular

Typical Profile

Surface layer:
 0 to 9 inches--very dark gray loamy fine sand
Subsurface layer:
 9 to 11 inches--grayish brown loamy fine sand
Subsoil:
 11 to 22 inches--mottled reddish brown loamy fine sand
 22 to 29 inches--mottled brown loamy fine sand
Substratum:
 29 to 35 inches--yellowish brown loamy fine sand
 35 inches--sandstone bedrock (Limestone bedrock is typical of the Sundell series, but the entire survey area is underlain by sandstone bedrock)

Soil Properties and Qualities

Depth class: Moderately deep
Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: 1.0 to 2.0 feet below the surface
Surface runoff: Slow
Flooding: None

Composition

Sundell, sandy var. soil and similar soils: 80 to 90 percent
 Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
 The poorly drained Jacobsville and Burt soils in drainageways and depressions.
 The well drained Deerton soil in higher landscape positions.

Similar inclusions:

Areas south of the Grand Sable Dunes that have a loamy very fine sand surface layer. Areas with depths to bedrock less than 20 inches or greater than 40 inches.

Use and Management

Land use: Recreation

Major management concerns: Wetness, sandy soil texture.

Management measures: Due to the sandy surface layer and high water table of this map unit, the area has severe limitations for camp areas and moderate limitations for picnic areas and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Controlling access to camp and picnic areas during the periods in spring or fall when this soil is wet and protecting paths and trails with wood chips or other suitable mulch material will minimize the wetness limitations. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 3W

Ta--Tawas muck**Setting**

Landscape position: Level low lying flats and depressions.

Landform: Outwash plains, lake plains and till plains.

Shape of areas: Irregular or linear

Typical Profile*Surface layer:*

0 to 4 inches--very dark grayish brown mucky peat

Subsurface layer:

4 to 11 inches--black muck

Subsoil:

11 to 18 inches--very dark gray muck

Substratum:

18 to 60 inches--dark grayish brown sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Moderately slow in the organic layers and rapid in the sandy layers.

Available water capacity: Very high in the organic layers and low in the sandy layers.

Drainage class: Very poorly drained

Seasonal high water table: 1 foot above to 1 foot below the surface

Surface runoff: Very slow or ponded

Flooding: None

Composition

Tawas soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions*Contrasting inclusions:*

Areas of the somewhat poorly drained Au Gres soils in slightly higher landscape positions.

Similar inclusions:

Areas with greater than 51 inches of muck over mineral soil.

Areas with less 16 inches of muck on the surface.

Use and Management

Land use: Recreation

Major management concerns: Ponding, excess humus.

Management measures: Due to the ponding of surface water and the muck surface layer of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The limitations are so severe that it is not practical to overcome them for camp or picnic areas. Paths or trails that cross this map unit must be elevated with a boardwalk or similar structure to minimize the limitations.

Interpretive Groups*Land capability classification:* TW**TrB--Trenary fine sandy loam, 2 to 6 percent slopes****Setting***Landscape position:* Nearly level to undulating upland flats.*Landform:* Ground moraines.*Shape of areas:* Irregular**Typical Profile***Surface layer:*

0 to 3 inches--very dark gray fine sandy loam

Subsurface layer:

3 to 6 inches--brown fine sandy loam

Subsoil:

6 to 12 inches--dark reddish brown fine sandy loam

12 to 17 inches--reddish brown fine sandy loam

17 to 26 inches--firm reddish brown sandy loam

26 to 37 inches--dark reddish brown sandy clay loam

Substratum:

37 to 60 inches--reddish brown sandy loam.

Soil Properties and Qualities*Depth class:* Very deep*Permeability:* Moderately slow.*Available water capacity:* Moderate*Drainage class:* Well drained*Seasonal high water table:* >60 inches below the surface*Surface runoff:* Slow*Flooding:* None**Composition**

Trenary soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions*Contrasting inclusions:*

Somewhat poorly and poorly drained soils in depressions and drainageways.

Similar inclusions:

Areas with very firm subsoil layers.

Use and Management**Land use:** Recreation*Major management concerns:* None.*Management measures:* This map unit has slight limitations for camp areas, picnic areas and paths and trails.**Interpretive Groups***Land capability classification:* 2E**TrD--Trenary fine sandy loam, 12 to 18 percent slopes****Setting***Landscape position:* Gently rolling to rolling sideslopes, knolls and ridges.*Landform:* Ground moraines.*Shape of areas:* Irregular**Typical Profile***Surface layer:*

0 to 3 inches--very dark gray fine sandy loam

Subsurface layer:

3 to 6 inches--brown fine sandy loam

Subsoil:

6 to 12 inches--dark reddish brown fine sandy loam

12 to 17 inches--reddish brown fine sandy loam

17 to 26 inches--firm reddish brown sandy loam

26 to 37 inches--dark reddish brown sandy clay loam

Substratum:

37 to 60 inches--reddish brown sandy loam.

Soil Properties and Qualities*Depth class:* Very deep*Permeability:* Moderately slow.*Available water capacity:* Moderate*Drainage class:* Well drained*Seasonal high water table:* >60 inches below the surface*Surface runoff:* Medium*Flooding:* None

Composition

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

Inclusions*Contrasting inclusions:*

Somewhat poorly and poorly drained soils in depressions and drainageways.

Similar inclusions:

Areas with very firm subsoil layers.
 Areas of the Trenary soil with steeper or gentler slopes.

Use and Management

Land use: Recreation

Major management concerns: Slope steepness.

Management measures: Due to the steep slopes of this map unit, the area has severe limitations for camp areas, picnic areas, and moderate limitations for paths and trails. Overcoming the slope limitations in camp and picnic areas is not practical, and paths and trails should be placed on the contours as much as possible to minimize the slope limitations.

Interpretive Groups

Land capability classification: 4E

WaA--Wainola fine sand, 0 to 4 percent slopes

Setting

Landscape position: Nearly level to undulating flats and depressions.

Landform: Lake plains.

Shape of areas: Irregular

Typical Profile*Surface layer:*

0 to 2 inches--black undecomposed forest litter

Subsurface layer:

2 to 11 inches--pinkish gray fine sand

Subsoil:

11 to 14 inches--mottled dark reddish brown fine sand

14 to 17 inches--mottled dark brown fine sand

17 to 26 inches--mottled strong brown fine sand

Substratum:

26 to 60 inches--reddish brown fine sand

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid

Available water capacity: Low

Drainage class: Somewhat poorly drained
Seasonal high water table: 0.5 to 1.5 feet below the surface

Surface runoff: Slow

Flooding: None

Composition

Wainola soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions*Contrasting inclusions:*

The moderately well drained Croswell soils and well drained Rubicon soils in higher landscape positions.

The poorly drained Roscommon soils in drainageways and depressions.

Similar inclusions:

Areas that have a sand surface layer.

Use and Management

Land use: Recreation

Major management concerns: Wetness, sandy soil texture.

Management measures: Due to the sandy surface layer and high water table of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation.

Controlling access to camp and picnic areas during the periods in spring or fall when this soil is wet and protecting paths and trails

with wood chips or other suitable mulch material will minimize the wetness limitations. In most years, the periods when this map unit is wet will coincide with periods of low visitor usage, which further minimizes the wetness management concerns.

Interpretive Groups

Land capability classification: 3W

YaB--Yalmer sand, 0 to 6 percent slopes

Setting

Landscape position: Nearly level to undulating upland flats.

Landform: Ground moraines.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 2 inches--black organic matter

Subsurface layer:

2 to 9 inches--reddish gray sand

Subsoil:

9 to 16 inches--dark reddish brown sand

16 to 26 inches--reddish brown and yellowish red sand

26 to 38 inches--light reddish brown and reddish brown mottled, firm sandy loam

38 to 43 inches--reddish brown sandy loam

Substratum:

43 to 60 inches--reddish brown sandy loam

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid in the sandy upper part, slow in the firm part of the subsoil, moderate in the underlying material

Available water capacity: Low (in the upper sandy portion)

Drainage class: Moderately well drained

Seasonal high water table: Perched, 1.5 to 2.0 feet below the surface

Surface runoff: Slow

Flooding: None

Composition

Yalmer soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Assinins soils and the poorly drained Roscommon soils in depressions and drainageways.

The moderately well drained Munising soils in similar landscape positions

Similar inclusions:

Areas that are sandy to a depth of 60 inches.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture, slow percolation rate

Management measures: Due to the sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The slow permeability in the firm part of the subsoil also causes severe limitations for camp and picnic areas. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation. Avoiding the use of this map unit as a camp or picnic area during excessively wet periods can minimize the slow permeability limitation.

Interpretive Groups

Land capability classification: 3D

YaD--Yalmer sand, 6 to 18 percent slopes

Setting

Landscape position: Gently rolling to rolling sideslopes, knolls and ridges.

Landform: Ground moraines.

Shape of areas: Irregular

Typical Profile

Surface layer:

0 to 2 inches--black organic matter

Subsurface layer:

2 to 9 inches--reddish gray sand

Subsoil:

9 to 16 inches--dark reddish brown sand

16 to 26 inches--reddish brown and yellowish red sand

26 to 38 inches--light reddish brown and reddish brown mottled, firm sandy loam

38 to 43 inches--reddish brown sandy loam

Substratum:

43 to 60 inches--reddish brown sandy loam

Soil Properties and Qualities

Depth class: Very deep

Permeability: Rapid in the sandy upper part, slow in the firm part of the subsoil, moderate in the underlying material

Available water capacity: Low (in the upper sandy portion)

Drainage class: Moderately well drained

Seasonal high water table: Perched, 1.5 to 2.0 feet below the surface

Surface runoff: Slow

Flooding: None

Composition

Yalmer soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

The somewhat poorly drained Assinins soils and the poorly drained Roscommon soils in depressions and drainageways.

The moderately well drained Munising soils in similar landscape positions.

Similar inclusions:

Areas that are sandy to a depth of 60 inches.

Use and Management

Land use: Recreation

Major management concerns: Sandy soil texture, slow percolation rate

Management measures: Due to the sandy nature of this map unit, the area has severe limitations for camp areas, picnic areas, and paths and trails. The slow permeability in the firm part of the subsoil also causes severe limitations for camp and picnic areas. The soil is too droughty to maintain enough vegetation to withstand heavy foot traffic during dry periods, and loose sand can cause trafficability problems. Protecting intensively used areas with wood chips or other suitable mulch material and topsoiling and seeding can help minimize this limitation. Avoiding the use of this map unit as a camp or picnic area during excessively wet periods can minimize the slow permeability limitation.

Interpretive Groups

Land capability classification: 3D

Use and Management of the Soils

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

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

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (21). 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, recreation, and for engineering purposes.

In the capability class system for this survey, the soils are grouped at two levels. The broadest group is called the capability class and is designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical uses. The classes are 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, or s to the class numeral, for example IIe. The letter e shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is droughty.

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 or s because the soils in class V are subject to little or erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units".

Woodland Management and Productivity

Table 2 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. In table 2 *slight*, *moderate*, and *severe* indicate the degree of the major soil limitation to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The

factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary, and 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 site index and as a volume number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The volume, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced on a fully stocked, even-aged, unmanaged stand. The volume was

determined through the use of standard yield tables (19).

The first species listed under common trees for a soil is the indicator species for that soil. It is the dominant species on the soil.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, 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 13 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 13 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 SCS or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 4 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 4, the degree of soil limitation is expressed as *slight*, *moderate*, or *severe*. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 4 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 9 and interpretations for dwellings without basements and for local roads and streets in table 10.

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 slope 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. Steep 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

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 3, 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 of kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, 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, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard.

Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are blueberries, goldenrod, wintergreen, and wheatgrass.

Hardwood trees and wood understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, apple, hawthorn, dogwood, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse 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, balsam 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, salinity, slope and surface stoniness. Examples of wetland plants are smartweed, 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 depth to bedrock, wetness, surface stoniness, slope and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted include some bird species, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous

plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include ruffed grouse, woodcock, woodpeckers, squirrels, raccoon, deer and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to these areas are ducks, geese, herons, shore birds, muskrat, mink and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations

were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is

needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan or a very firm dense layer, stone content, soil texture and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwelling no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, 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 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 affect trafficability after vegetation is established.

Sanitary Facilities

Table 9 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 9 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated *good*; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties

requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to 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 9 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function

unsatisfactory. 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 soil waste is disposed of by burying it in soil. There are two types of landfill, trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 9 are based on soil properties, site features and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 5 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 11 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 *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 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the rating.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted

and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for

use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or 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 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 12 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 fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

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, permeability of the aquifer, and quality of the water as inferred from the salinity of

the soil. Depth to bedrock and the content of large stones affect 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 bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavation and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce water erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintainance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity,

restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.



Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 5 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 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If 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 and the system adopted by the American Association of State Highway and Transportation Officials (1; 2).

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 properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement,

the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeter, 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 6 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 absorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affect behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity

is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place.

Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility of soil to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sand, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 6, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 7 gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 7 shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on

thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Table 8 gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils have 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 8, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 8 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2

years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; Irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 8 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 8.

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 5 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.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (22)). 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 14 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

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 Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

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 a soil. An example is Haplaquents (*Hapl*, meaning minimal horizonation, plus *aquent*, the suborder of the entisols that have an aquatic moisture regime).

SUBGROUP. Each great has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more

adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, nonacid, mesic, Typic Haplaquents.

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 that is not recognized in the Soil Survey of Delta County and Hiawatha National Forest of Alger and Schoolcraft Counties, Michigan is described. The descriptions for the Assinins, Halfaday, and Jacobsville series are arranged in alphabetic order. The descriptions provided for these series are the representative pedons for the series and were not taken from the PRNL soil survey area. Pedon descriptions from Alger county for these 3 series will be included in the final Soil Survey of the Alger County Area report. Descriptions for the remainder of the soil series in this publication can be found in the Delta-Hiawatha soil survey publication. An important point is that the East Lake, acid

variant soil in the Delta-Hiawatha soil survey was recorrelated to the Adams series. The reader should refer to the East Lake, acid variant description in the Delta-Hiawatha report for information on the Adams series in the PRNL publication.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (20). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (22)). 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."

Assinins Series

The Assinins series consists of very deep, somewhat poorly drained soils on ground moraines. These soils 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 3 percent.

Typical pedon of Assinins sand:

Oe--0 to 2 inches; partially decomposed leaf litter; strong medium granular structure; very friable; many fine and medium roots; very strongly acid, abrupt smooth boundary.

E--2 to 8 inches; brown (7.5YR 5/2) sand; many medium faint dark grayish brown (10 YR 4/2) and light brownish gray (10 YR 6/2) mottles; weak fine subangular blocky structure parting to weak medium granular; very friable; many fine and medium roots; about 5% gravel; very strongly acid; abrupt wavy boundary.

Bs1--8 to 13 inches; reddish brown (5YR 4/3) sand; Weak fine subangular blocky structure parting to weak

medium granular; very friable; many fine and medium roots; about 5% gravel; strongly acid; abrupt wavy boundary.

Bs2--13 to 22 inches; brown (7.5 YR 4/4) sand; common fine distinct strong brown (7.5 YR 5/6) and many medium distinct yellowish brown (10 YR 5/4) mottles; weak fine subangular blocky structure; very friable; common fine roots; about 5 percent gravel; strongly acid; abrupt wavy boundary.

2B/E--22 to 31 inches; reddish brown (2.5YR 4/4) sandy clay loam (Bt); occupies about 75 percent of the horizon completely surrounded by or penetrated by fingers of pinkish gray (5YR 6/2) loamy sand (E); many fine and medium distinct strong brown (7.5R 5/6 and 5/8) mottles; weak medium subangular blocky structure; firm; few fine roots; common pores; reddish brown (5YR 5/3) clay flows in pores; about 5 percent gravel; medium acid; clear wavy boundary.

2C-31 to 60 inches; reddish brown (2.5YR 4/4) sandy loam; few fine distinct pinkish gray (5YR 6/2) mottles; weak fine subangular blocky structure; friable; about 5 percent gravel; medium acid.

The thickness of the sandy material ranges from 20 to 40 inches. The thickness of the solum ranges from 26 to 55 inches. The solum has 1 to 10 percent gravel.

The E horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 2 or 3. The A and E horizons are dominantly sand, but the range includes loamy sand and fine sand.

The B horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. It is sand, loamy sand, or fine sand. The E part of the 2B/E horizon has value of 4 or 5 and chroma of 2 or 3. It is sand, loamy sand, or sandy loam. The Bt part has hue of 2.5YR or 5YR. It is sandy loam or fine sandy loam.

The 2C horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. It is sandy loam or fine sandy loam.

Halfaday Series

The Halfaday series consists of very deep, moderately well drained, rapidly permeable soils on outwash plains, lake plains, stream terraces, and till plains. These soils formed in sandy material. Slopes range from 0 to 3 percent.

Typical pedon of Halfaday sand:

- Oe--1 to 0 inches; partially decomposed hardwood litter.
- A--0 to 1 inch; black (10YR 2/1) sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many fine roots; strongly acid; clear wavy boundary.
- E--1 to 7 inches; brown (7.5YR 5/2) sand; single grain; loose; many fine and common medium roots; strongly acid; clear Irregular boundary.
- Bhs--7 to 13 inches; dark reddish brown (5R 2/2) sand; weak medium subangular blocky structure; very friable; few fine roots; weakly cemented ortstein; strongly acid; abrupt irregular boundary.
- Bs1--13 to 17 inches; dark brown (7.5YR 3/4) (60 percent) and strong brown (7.5YR 4/6) (40 percent) sand; weak coarse subangular blocky structure; very friable; common fine roots; weakly cemented ortstein; strongly acid; clear irregular boundary.
- Bs2--17 to 30 inches; dark brown (7.5YR 4/4) (60 percent) and brownish yellow (10YR 6/6) (40 percent) sand; common fine distinct pink (7.5YR 7/4) mottles below 24 inches; weak medium subangular blocky structure; very friable; very few fine roots; few weakly cemented fragments of ortstein; strongly acid; gradual wavy boundary.
- BC--30 to 37 inches; yellowish brown (10YR 5/6) sand; common fine and medium faint light yellowish brown (10YR 6/4) mottles; single grain; loose; very few very fine roots; medium acid; gradual wavy boundary.
- C--37 to 60 inches; brownish yellow (10YR 6/6) sand; few fine faint pink (7.5YR

7/4) mottles; single grain; loose; medium acid.

The thickness of the solum ranges from 30 to 45 inches. The content of gravel ranges from 0 to 10 percent.

The A horizon, if it occurs, has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. The E horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. The Bs horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. The C horizon has value of 5 to 7 and chroma of 3 to 6.

Jacobsville Series

The Jacobsville series consists of moderately deep, poorly drained, moderately permeable soils on till plains and sandstone benches. These soils formed in loamy and sandy glacial till over sandstone bedrock. Slopes are 0 to 2 percent.

Typical pedon of Jacobsville muck:

- Oa--0 to 5 inches; black (N 2/0) muck; weak fine subangular blocky structure; very friable; many roots; strongly acid; abrupt smooth boundary.
- Eg--5 to 9 inches; dark reddish gray (5YR 4/2) sandy loam; common medium prominent strong brown (7.5YR 4/6) mottles; weak medium subangular blocky structure; friable; few roots; about 5 percent gravel; strongly acid; clear wavy boundary.
- Bw--9 to 23 inches; dark reddish brown (2.5YR 3/4) sandy loam; common medium prominent dark brown (7.5YR 4/2) and few fine prominent strong brown (7.5YR 4/6) mottles; weak fine and medium subangular blocky structure; friable; about 5 percent gravel; medium acid; clear wavy boundary.
- C--23 to 36 inches; reddish brown (2.5YR 4/4) sandy loam; many medium prominent dark reddish gray (5YR 4/2), common medium prominent pinkish gray (7.5YR 6/2) and few medium prominent strong brown (7.5YR 5/8) mottles; weak medium

subangular blocky structure; friable;
about 5 percent gravel; medium acid;
clear smooth boundary.

2R--36 inches; reddish brown (2.5YR 4/4)
sandstone bedrock.

The depth to bedrock and the thickness of the solum range from 20 to 40 inches. The volume of gravel or sandstone fragments ranges from 0 to 10 percent in the solum and from 0 to 60 percent in the C horizon.

The Oa horizon has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. Some pedons have an A horizon. The A horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2. The A horizon is dominantly mucky sandy loam, but the range includes mucky fine sandy loam and mucky loamy sand. The Eg horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 1 or 2. It is loamy sand or sandy loam. The Bw horizon has hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 3 or 4. The C horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is sandy loam, loamy sand, or the channery or very channery analogs of those textures.

References

- (1) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.
- (2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487.
- (3) Bergquist, S.C. 1936. The Pleistocene history of the Tahquamenon and Manistique drainage region of the northern peninsula of Michigan. Michigan Geological Survey Publication 40, Geological Series 34, part 1 pp.7-148.
- (4) Blewett, W.L. and R.L. Rieck. 1987. Reinterpretation of a portion of the Munising Moraine in northern Michigan. Geological Society of America Bulletin 98:169-175.
- (5) Dorr, J.A. and D.F. Eschman. 1972. Geology of Michigan. University of Michigan Press. 476 p.
- (6) Drexler, C.W. 1981. Outlet channels for the post-Duluth lakes of the Upper Peninsula of Michigan. PhD dissertation, University of Michigan, Ann Arbor. 295 p.
- (7) Drexler, C.W., W.R. Farrand and J.D. Hughes. 1983. Correlation of glacial lakes in the Superior Basin with eastward discharge events from Lake Agassiz. in Teller, J.T. and L. Clayton (eds.) Glacial Lake Agassiz. Geological Association of Canada Special Paper 26, pp. 309-329.
- (8) Eichenlaub, 1979. Weather and Climate of the Great Lakes Region. University Notre Dame Press. 335 p.
- (9) Farrand, W.R. and C.W. Drexler. 1985. Late Wisconsinan and Holocene history of the Lake Superior Basin. In Karrow, P.F. and P.E. Calkin (eds.) Quaternary Evolution of the Great Lakes. Geological Association of Canada Special Paper 30, pp. 18-32.
- (10) Farrell, J.P. and J.D. Hughes. 1985. Long term implications, from a geomorphological standpoint, of maintaining H-58 in its present location at Grand Sable Lake. Contract report to the National Park Service, Munising, MI. 78 p.
- (11) Haddox, C.A. and R.H. Dott. 1990. Cambrian shoreline deposits in northern Michigan. Journal of Sedimentary Petrology 60:697-716.
- (12) Hamblin, W.K. 1958. Cambrian sandstones of Northern Michigan. Michigan Department of Conservation, Geological Survey Division, Publication 51. 146 p.
- (13) Hough, J.L. 1958. Geology of the Great Lakes. University of Illinois Press, Urbana. 313 p.
- (14) Hughes, J.D. 1978. Marquette buried forest 9850 years old: abstract for the American Association for the Advancement of Science Annual Meeting, February 12-17.

- (15) Larsen, C.E. 1987. Geological history of Glacial Lake Algonquin and the Upper Great Lakes. U.S. Geol. Surv. Bulletin 1801. 36 p.
- (16) Leverett, F. 1929. Moraines and shorelines of the Lake Superior region. U.S. Geological Survey Prof. Paper 154-A. 72 p.
- (17) Marsh, W.M. and B.D. Marsh. 1987. Wind erosion and sand dune formation on high Lake Superior bluffs. Geographiska Annaler 69:379-391.
- (18) Strommen, N.D. 1971. Climate of Michigan by stations: 1940-1969. Michigan Dept. of Agriculture/ Michigan Weather Service, Lansing.
- (19) United States Department of Agriculture, Soil Conservation Service. 1980. National Forestry Manual.
- (20) United States Department of Agriculture. 1951. Soil Survey Manual. U.S. Dept. Agric. Handbook 18, 503 pp., illus.
- (21) United States Department of Agriculture. 1961. Land capability classification. U.S. Dept. Agric. Handb. 210, 21 pp.
- (22) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dept. Agric. Handb. 436, 754 pp., illus.

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 inches
Low-----	3 to 6 inches
Moderate-----	6 to 9 inches
High-----	9 to 12 inches
Very high-----	more than 12 inches

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter.

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 skins.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble. A rounded or partly rounded fragment of rock 2 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil.

Calcium carbonate and iron oxide are common compounds in concretions.

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 in 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.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cuesta (geology). An elevated area with a steep face on one side and a long gentle slope on the other.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth class (soil). The depth below the soil surface to a contrasting or limiting layer. If the nature of the contrasting layer is not given, it is understood to be consolidated bedrock.

Very shallow Less than 10 inches
 Shallow 10 to 20 inches
 Moderately deep 20 to 40 inches
 Deep 40 to 60 inches
 Very deep Greater than 60 inches

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation. 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. Some are steep. All are free of 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 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 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 thru 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 affects 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, 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. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, 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 in depressions and are frequently ponded.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Excess fines (in table). 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.

Floodplain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Forb. Any herbaceous plant not a grass or sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage buildings, roads, and other structures, and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melted ice. The deposits are stratified and

occur as kames, eskers, deltas, and outwash plains.

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.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

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 matter.

E horizon- The mineral horizon in which the main feature is the 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 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.

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 permanent high water table. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain (geology). A nearly level surface marking the floor of an extinct lake filled in by well-sorted stratified sediments.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Litter layer. A zone of accumulation of organic material such as leaves, twigs, and grass, in various stages of decomposition, that lies above the mineral soil. Often described in forested regions and commonly called a duff layer.

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 (in tables). The soil is not strong enough to support loads.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure,

porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance- few, common, and many; size- fine, medium, and coarse; and contrast- faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. 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.

Mucky peat. Organic soil material intermediate in degree of decomposition between the less decomposed peat and the more decomposed muck material.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain (geology). A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Outwash terrace (geology). An upland landform of coarse textured material of glaciofluvial origin. A step-like surface which borders a valley floor or lower landscape position.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Undecomposed organic matter that has accumulated under excess moisture. 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.

Pedon. The smallest volume that can be called "a soil". A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (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

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which the soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as- pH

Extremely acid-----below 4.5
 Very strongly acid-----4.5 to 5.0
 Strongly acid-----5.1 to 5.5
 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

Relief. The elevations or inequalities of a land surface, considered collectively.

Remnant moraine (geology). An upland landform composed of glacial drift developed by collapse and flow of stagnant ice as it melted.

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.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeters 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.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can adversely affect the specified use. It can also damage plant roots.

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 arbitrary chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure

satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use.

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.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principle forms of 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 organic soils).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum. Commonly the C horizon.

Subsurface layer. Any surface soil horizon (A, E, 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".

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a glacial outwash channel, or lake.

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 subdivided by specifying "coarse", "fine", or "very fine".
Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

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.

TABLES



TABLE 1.—ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ad	Alluvial land	132	0.2
AsA	Assinins sand, 0 to 3 percent slopes	12	*
AuB	Au Gres sand, 0 to 6 percent slopes	385	0.7
BIB	Blue Lake sand, 0 to 6 percent slopes	99	0.2
BID	Blue Lake sand, 6 to 18 percent slopes	242	0.5
BIE	Blue Lake sand, 18 to 40 percent slopes	41	0.1
BoB	Bohemian fine sandy loam, 0 to 6 percent slopes	27	0.1
BoD	Bohemian fine sandy loam, 6 to 18 percent slopes	49	0.1
Bp	Borrow pits	19	*
Bs	Brevort mucky loamy sand	2	*
BtA	Brimley fine sandy loam, 0 to 4 percent slopes	37	0.1
Bu	Bruce muck, coarse Variant	13	*
BwC	Burt mucky sandy loam, 2 to 12 percent slopes	466	0.9
Cb	Carbondale, Lupton, and Rifle soils	2,871	5.4
Ck	Cathro and Tacoosh mucks	44	0.1
CmD	Chatham fine sandy loam, 6 to 18 percent slopes	64	0.1
Cn	Chippeny muck	1,691	3.2
CrA	Croswell sand, 0 to 4 percent slopes	267	0.5
Dd	Dawson and Greenwood peats	124	0.2
DeB	Deerton sand, 0 to 6 percent slopes	2,410	4.5
DeD	Deerton sand, 6 to 18 percent slopes	145	0.3
DIB	DeertonBurt complex, 0 to 6 percent slopes	303	0.6
Dn	Duneland, moderately sloping to steep	1,710	3.2
DnG	Duneland, very steep	251	0.5
EcB	Adams loamy sand, 0 to 6 percent slopes	3,415	6.4
EcD	Adams loamy sand, 6 to 18 percent slopes	202	0.4
EkB	AdamsKalkaska complex, 0 to 6 percent slopes	287	0.5
EkD	AdamsKalkaska complex, 6 to 18 percent slopes	124	0.2
EkE	AdamsKalkaska complex, 18 to 40 percent slopes	117	0.2
Es	Ensley and Angelica soils	196	0.4
Gw	Greenwood peat	26	*
HaB	Halfaday sand, 0 to 4 percent slopes	301	0.6
IoB	Iosco sand, 0 to 6 percent slopes	10	*
Jb	JacobsvilleBurt complex	360	0.7
KaB	Kalkaska sand, 0 to 6 percent slopes	5,831	10.9
KaD	Kalkaska sand, 6 to 18 percent slopes	3,207	6.0
KaE	Kalkaska sand, 18 to 40 percent slopes	1,645	3.1
KaG	Kalkaska sand, 40 to 80 percent slopes	677	1.3
KdB	Karlin sandy loam, 0 to 6 percent slopes	2,012	3.8
KdD	Karlin sandy loam, 6 to 18 percent slopes	186	0.3
KdE	Karlin sandy loam, 18 to 40 percent slopes	124	0.2
KgC	Kawbawgam sandy loam, 0 to 10 percent slopes	119	0.2
KmB	KalkaskaMunising complex, dissected, 1 to 12 percent slopes	151	0.3
KmD	KalkaskaMunising complex, dissected, 8 to 35 percent slopes	210	0.4
KmE	KalkaskaMunising complex, dissected, 15 to 60 percent slopes	269	0.5
KnB	Keweenaw loamy sand, 0 to 6 percent slopes	177	0.3
KnD	Keweenaw loamy sand, 6 to 18 percent slopes	27	0.1
Kr	Kinross muck	4	*
Lb	Lake beaches	187	0.4
McB	Mancelona loamy sand, 0 to 6 percent slopes	16	*
Mh	Marsh	61	0.1
MuB	Munising sandy loam, 0 to 6 percent slopes	3,106	5.8
MuD	Munising sandy loam, 6 to 18 percent slopes	2,050	3.8
MuE	Munising sandy loam, 18 to 40 percent slopes	325	0.6
Nh	Nahma muck	47	0.1
OoE	OnotaChippeny complex, 0 to 35 percent slopes	353	0.7
OrB	OnotaDeerton complex, 0 to 6 percent slopes	946	1.8
OrD	OnotaDeerton complex, 6 to 18 percent slopes	557	1.0
OtB	Otisco loamy sand, 0 to 6 percent slopes	20	*
Rc	Roscommon muck	826	1.5
RkB	RoscommonKalkaska complex, 0 to 6 percent slopes	869	1.6
RuB	Rubicon sand, 0 to 6 percent slopes	5,169	9.7
RuD	Rubicon sand, 6 to 18 percent slopes	2,203	4.1

* See footnote at end of table.

TABLE 1.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
RuE	Rubicon sand, 18 to 40 percent slopes	233	0.4
ShB	Shelldrake sand, 0 to 8 percent slopes	1,767	3.3
SkB	Skaneesee sandy loam, 0 to 6 percent slopes	192	0.4
StB	Steuben fine sandy loam, 0 to 6 percent slopes	33	0.1
StD	Steuben fine sandy loam, 6 to 18 percent slopes	28	0.1
SvA	Sundell fine sandy loam, 0 to 4 percent slopes	8	*
SwA	Sundell loamy fine sand, sandy Variant, 0 to 4 percent slopes	29	0.1
Ta	Tawas mucky peat	1,056	2.0
TrB	Trenary fine sandy loam, 2 to 6 percent slopes	51	0.1
TrD	Trenary fine sandy loam, 12 to 18 percent slopes	13	*
WaA	Wainola fine sand, 0 to 4 percent slopes	11	*
YaB	Yalmer sand, 0 to 6 percent slopes	97	0.2
YaD	Yalmer sand, 6 to 18 percent slopes	139	0.3
	Water	1,920	3.6
	Total	53,373	100.0

* Less than 0.1 percent.

TABLE 2.—WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
AsA— Assinins	3W	Slight	Severe	Moderate	Severe	Red maple— American basswood— Eastern hemlock— Bigtooth aspen— Balsam fir— Yellow birch— Quaking aspen— White spruce— Sugar maple—	65 — — — — — — — 63	40 — — — — — — — 39	White spruce, Norway spruce, eastern white pine.
AuB— Au Gres	6W	Slight	Severe	Moderate	Severe	Quaking aspen— Bigtooth aspen— Balsam fir— Paper birch— Yellow birch— Red maple— Eastern hemlock— Eastern white pine— Northern whitecedar— Jack pine— Red pine—	70 — — — — 65 — — — 51 61	81 — — — — 40 — — — 69 107	White spruce, red pine, eastern white pine, Norway spruce.
BIB, BID— Blue Lake	3S	Slight	Moderate	Moderate	Slight	Sugar maple— Yellow birch— Quaking aspen— Eastern white pine— Eastern hemlock— American beech—	64 — — — — —	40 — — — — —	Red pine, eastern white pine, jack pine.
BIE— Blue Lake	3R	Moderate	Moderate	Moderate	Slight	Sugar maple— Yellow birch— Quaking aspen— Eastern white pine— Eastern hemlock— American beech—	64 — — — — —	40 — — — — —	Red pine, eastern white pine, jack pine.
BoB, BoD— Bohemian	3L	Slight	Moderate	Slight	Slight	Sugar maple— Red maple— Yellow birch— American beech— American basswood— Eastern white pine— Eastern hemlock— Paper birch— Balsam fir—	67 — — — — — — — —	41 — — — — — — — —	Red pine, white spruce, eastern white pine, white ash.
Bs— Brevort	2W	Slight	Severe	Severe	Severe	Quaking aspen— Balsam fir— Northern whitecedar— American basswood— Red maple— Black spruce—	40 — — — — 15	22 — — — — 23	Eastern white pine, northern whitecedar.

* Volume class is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 2.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
BtA----- Brimley	3W	Slight	Severe	Slight	Moderate	Sugar maple----- Northern red oak--- Black ash----- Yellow birch----- Eastern white pine-- Red maple----- Balsam fir----- Northern whitecedar- Eastern hemlock---	60 -- -- -- -- -- -- -- --	38 -- -- -- -- -- -- -- --	White spruce, eastern white pine, northern whitecedar.
Bu----- Bruce Variant	6W	Slight	Severe	Severe	Severe	Balsam fir----- Quaking aspen----- Red maple----- Northern whitecedar- Yellow birch-----	45 -- -- -- --	80 -- -- -- --	
BwC----- Burt	2W	Slight	Severe	Severe	Severe	Quaking aspen----- Red maple----- Northern whitecedar- Black spruce----- Eastern hemlock----- Balsam fir-----	45 -- -- -- -- --	32 -- -- -- -- --	
Cb**: Carbondale---	5W	Slight	Severe	Severe	Severe	Balsam fir----- Black spruce----- Northern whitecedar- Tamarack----- Paper birch----- Silver maple-----	40 15 -- -- -- 78	71 23 -- -- -- 32	
Lupton-----	2W	Slight	Severe	Severe	Severe	Black spruce----- Balsam fir----- Black ash----- Northern whitecedar- Paper birch----- Tamarack----- Red maple----- Quaking aspen----- White spruce-----	20 46 -- -- -- -- -- -- --	29 86 -- -- -- -- -- -- --	
Rifle-----	5W	Slight	Severe	Severe	Severe	Balsam fir----- Northern whitecedar- Black ash----- Tamarack----- American basswood-- Paper birch----- Black spruce-----	40 -- -- -- -- -- --	71 -- -- -- -- -- --	
Ck**: Cathro-----	5W	Slight	Severe	Severe	Severe	Balsam fir----- Northern whitecedar- Tamarack----- Paper birch----- Red maple----- Black spruce----- White spruce-----	40 -- 35 -- -- 15 --	71 -- 22 -- -- 23 --	White spruce.

* Volume class is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 2.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
Ck**: Tacoosh	5W	Slight	Severe	Severe	Severe	Balsam fir	40	71	Black spruce, tamarack, northern whitecedar.
						White spruce	40	72	
						Black ash	--	--	
						Black spruce	--	--	
						Red maple	--	--	
						Tamarack	--	--	
						Quaking aspen	--	--	
						Northern whitecedar	--	--	
CmD Chatham	3L	Slight	Moderate	Slight	Slight	Sugar maple	61	38	Red pine, eastern white pine, jack pine.
						Yellow birch	--	--	
						Eastern white pine	--	--	
Cn Chippeny	4W	Slight	Severe	Severe	Severe	Balsam fir	35	60	
						Black ash	--	--	
						Paper birch	--	--	
						Northern whitecedar	35	51	
						Yellow birch	--	--	
						Red maple	--	--	
						Black spruce	--	--	
						Eastern hemlock	--	--	
Quaking aspen	--	--							
CrA 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	
Dd**: Dawson	2W	Slight	Severe	Severe	Severe	Black spruce	15	23	
						Tamarack	--	--	
Greenwood	2W	Slight	Severe	Severe	Severe	Black spruce	15	23	
						Balsam fir	39	69	
						Tamarack	--	--	
DeB, DeD Deerton	3D	Slight	Slight	Moderate	Moderate	Sugar maple	60	38	Red pine, jack pine.
						Quaking aspen	--	--	
						American basswood	--	--	
						Balsam fir	--	--	
						Paper birch	--	--	
						Red maple	--	--	
						Yellow birch	--	--	
						Bigtooth aspen	--	--	
						Eastern hemlock	--	--	

* Volume class is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 2.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
DIB**: Deerton	3D	Slight	Slight	Moderate	Moderate	Sugar maple Quaking aspen American basswood Balsam fir Paper birch Red maple Yellow birch Bigtooth aspen Eastern hemlock	60 -- -- -- -- -- -- -- --	38 -- -- -- -- -- -- -- --	Red pine, jack pine.
Burt	2W	Slight	Severe	Severe	Severe	Quaking aspen Red maple Northern whitecedar Black spruce Eastern hemlock Balsam fir	45 -- -- -- -- --	32 -- -- -- -- --	
EcB, EcD Adams	3S	Slight	Slight	Severe	Slight	Sugar maple Red maple American beech Eastern hemlock Eastern white pine	61 -- -- -- 66	38 -- -- -- 139	Eastern white pine, red pine, European larch.
EkB**, EkD**: Adams	3S	Slight	Slight	Severe	Slight	Sugar maple Red maple American beech Eastern hemlock Eastern white pine	61 -- -- -- 66	38 -- -- -- 139	Eastern white pine, red pine, European larch.
Kalkaska	3S	Slight	Moderate	Moderate	Slight	Sugar maple Quaking aspen Red pine Eastern white pine American beech Paper birch Northern red oak Red maple Bigtooth aspen	64 -- -- -- -- -- -- 63 80	40 -- -- -- -- -- -- 39 94	Red pine, eastern white pine.
EkE**: Adams	3S	Slight	Moderate	Severe	Slight	Sugar maple Red maple American beech Eastern hemlock Eastern white pine	61 -- -- -- 66	38 -- -- -- 139	Eastern white pine, red pine, European larch.
Kalkaska	3R	Moderate	Moderate	Moderate	Slight	Sugar maple Quaking aspen Red pine Eastern white pine American beech Paper birch Northern red oak Red maple Bigtooth aspen	64 -- -- -- -- -- -- 63 80	40 -- -- -- -- -- -- 39 94	Red pine, eastern white pine.

* Volume class is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 2.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
Es**: Ensley	3W	Slight	Severe	Severe	Severe	Red maple Balsam fir White spruce White ash Yellow birch Black ash	62 60 -- -- -- --	39 118 -- -- -- --	Green ash, white spruce.
Angelica	7W	Slight	Severe	Severe	Severe	Balsam fir Quaking aspen Paper birch Yellow birch Northern whitecedar Black ash	54 60 -- -- -- --	105 64 -- -- -- --	White spruce.
Gw Greenwood	2W	Slight	Severe	Severe	Severe	Black spruce Balsam fir Tamarack	15 39 --	23 69 --	
HaB Halfaday	3S	Slight	Moderate	Moderate	Moderate	Sugar maple Red pine	62 --	39 --	Red pine, eastern white pine.
IoB Iosco	5W	Slight	Severe	Moderate	Severe	Quaking aspen White ash Red maple Yellow birch Northern pin oak Eastern white pine Balsam fir Paper birch White spruce	65 -- -- -- -- -- 55 58 --	73 -- -- -- -- -- 107 62 --	Eastern white pine, white spruce.
Jb**: Jacobsville	2W	Slight	Severe	Severe	Severe	Red maple Balsam fir Yellow birch Quaking aspen Eastern hemlock	55 -- -- -- --	35 -- -- -- --	
Burt	2W	Slight	Severe	Severe	Severe	Quaking aspen Red maple Northern whitecedar Black spruce Eastern hemlock Balsam fir	45 -- -- -- -- --	32 -- -- -- -- --	
KaB, KaD Kalkaska	3S	Slight	Moderate	Moderate	Slight	Sugar maple Quaking aspen Red pine Eastern white pine American beech Paper birch Northern red oak Red maple Bigtooth aspen	64 -- -- -- -- -- -- 63 80	40 -- -- -- -- -- -- 39 94	Red pine, eastern white pine.

* Volume class is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 2.—WOODLAND MANAGEMENT AND PRODUCTIVITY—Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
KaE— Kalkaska	3R	Moderate	Moderate	Moderate	Slight	Sugar maple— Quaking aspen— Red pine— Eastern white pine— American beech— Paper birch— Northern red oak— Red maple— Bigtooth aspen—	64 — — — — — — 63 80	40 — — — — — — 39 94	Red pine, eastern white pine.
KaG— Kalkaksa	3R	Severe	Severe	Moderate	Slight	Sugar maple— Quaking aspen— Red pine— Eastern white pine— American beech— Paper birch— Northern red oak— Red maple— Bigtooth aspen—	64 — — — — — — 63 80	40 — — — — — — 39 94	Red pine, eastern white pine.
KdB, KdD— Karlín	3A	Slight	Slight	Slight	Slight	Sugar maple— Yellow birch— Bigtooth aspen— Northern red oak— American basswood— Red pine— Eastern white pine—	61 — — — — 65 —	38 — — — — 115 —	Red pine, eastern white pine, jack pine.
KdE— Karlín	3R	Moderate	Moderate	Slight	Slight	Sugar maple— Yellow birch— Bigtooth aspen— Northern red oak— American basswood— Red pine— Eastern white pine—	61 — — — — 65 —	38 — — — — 115 —	Red pine, eastern white pine, jack pine.
KgC— Kawbawgam	2W	Slight	Severe	Moderate	Severe	Red maple— Yellow birch— Balsam fir— Quaking aspen—	55 — — —	35 — — —	White spruce, eastern white pine, northern whitecedar.
KmB**: Kalkaska—	3S	Slight	Moderate	Moderate	Slight	Sugar maple— Quaking aspen— Red pine— Eastern white pine— American beech— Paper birch— Northern red oak— Red maple— Bigtooth aspen—	64 — — — — — — 63 80	40 — — — — — — 39 94	Red pine, eastern white pine.
Munising—	3W	Slight	Severe	Slight	Moderate	Sugar maple— Yellow birch— Eastern hemlock— Red maple— Bigtooth aspen— Balsam fir— Paper birch— White spruce—	63 — — — — — — —	39 — — — — — — —	White spruce, Norway spruce, red pine, eastern white pine.

* Volume class is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 2.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
KmD**: Kalkaska	3R	Moderate	Moderate	Moderate	Slight	Sugar maple	64	40	Red pine, eastern white pine.
						Quaking aspen	--	--	
						Red pine	--	--	
						Eastern white pine	--	--	
						American beech	--	--	
						Paper birch	--	--	
						Northern red oak	--	--	
						Red maple	63	39	
Bigtooth aspen	80	94							
Munusing	3R	Moderate	Moderate	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine, eastern white pine.
						Yellow birch	--	--	
						Eastern hemlock	--	--	
						Red maple	--	--	
						Bigtooth aspen	--	--	
						Balsam fir	--	--	
						Paper birch	--	--	
						White spruce	--	--	
Quaking aspen	--	--							
KmE**: Kalkaska	3R	Severe	Severe	Moderate	Slight	Sugar maple	64	40	Red pine, eastern white pine.
						Quaking aspen	--	--	
						Red pine	--	--	
						Eastern white pine	--	--	
						American beech	--	--	
						Paper birch	--	--	
						Northern red oak	--	--	
						Red maple	63	39	
Bigtooth aspen	80	94							
Munusing	3R	Severe	Severe	Slight	Moderate	Sugar maple	63	39	Norway spruce, white spruce, red pine, eastern white pine.
						Yellow birch	--	--	
						Eastern hemlock	--	--	
						Red maple	--	--	
						Bigtooth aspen	--	--	
						Balsam fir	--	--	
						Paper birch	--	--	
						White spruce	--	--	
Quaking aspen	--	--							
KnB, KnD Keweenaw	3A	Slight	Slight	Slight	Slight	Sugar maple	61	38	Eastern white pine, red pine.
						Eastern hemlock	--	--	
						Yellow birch	--	--	
						Northern red oak	64	57	
						Paper birch	60	65	
						Red maple	50	32	
						Black cherry	--	--	
						Eastern white pine	--	--	
						Balsam fir	--	--	
						Quaking aspen	--	--	
						Red pine	60	101	
Bigtooth aspen	74	86							

* Volume class is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 2.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
Kr----- Kinross	2W	Slight	Severe	Severe	Severe	Quaking aspen----- Black spruce----- Tamarack----- Northern whitecedar- Balsam fir----- Red maple----- Jack pine-----	45 -- -- -- -- -- --	32 -- -- -- -- -- --	
McB----- Mancelona	3A	Slight	Slight	Slight	Slight	Sugar maple----- Northern red oak--- Red pine----- Jack pine----- Eastern white pine- Yellow birch-----	58 -- -- -- -- --	37 -- -- -- -- --	Red pine, eastern white pine, jack pine.
MuB, MuD----- Munising	3W	Slight	Severe	Slight	Moderate	Sugar maple----- Yellow birch----- Eastern hemlock--- Red maple----- Bigtooth aspen--- Balsam fir----- Paper birch----- White spruce-----	63 -- -- -- -- -- -- --	39 -- -- -- -- -- -- --	White spruce, Norway spruce, red pine, eastern white pine.
MuE----- Munising	3R	Moderate	Moderate	Slight	Moderate	Sugar maple----- Yellow birch----- Eastern hemlock--- Red maple----- Bigtooth aspen--- Balsam fir----- Paper birch----- White spruce----- Quaking aspen---	63 -- -- -- -- -- -- -- --	39 -- -- -- -- -- -- -- --	Norway spruce, white spruce, red pine, eastern white pine.
Nh----- Nahma	4W	Slight	Severe	Severe	Severe	Balsam fir----- Quaking aspen--- Paper birch----- Northern whitecedar- Black ash----- Red maple----- Yellow birch----- White ash-----	35 -- -- -- -- -- -- --	60 -- -- -- -- -- -- --	
OoE**; Onota-----	3R	Moderate	Moderate	Slight	Slight	Sugar maple----- Eastern hemlock--- Yellow birch----- Paper birch----- Red maple----- Quaking aspen--- American beech--- Eastern white pine--	61 -- -- -- -- -- -- --	38 -- -- -- -- -- -- --	White spruce, red pine, eastern white pine.

* Volume class is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 2.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
OoE**: Chippeny	4W	Slight	Severe	Severe	Severe	Balsam fir Black ash Paper birch Northern whitecedar Yellow birch Red maple Black spruce Eastern hemlock Quaking aspen	35 -- -- 35 -- -- -- -- --	60 -- -- 51 -- -- -- -- --	
OrB**, OrD**: Onota	3L	Slight	Moderate	Slight	Slight	Sugar maple Eastern hemlock Yellow birch Paper birch Red maple Quaking aspen American beech Eastern white pine	61 -- -- -- -- -- -- --	38 -- -- -- -- -- -- --	White spruce, red pine, eastern white pine.
Deerton	3D	Slight	Slight	Moderate	Moderate	Sugar maple Quaking aspen American basswood Balsam fir Paper birch Red maple Yellow birch Bigtooth aspen Eastern hemlock	60 -- -- -- -- -- -- -- --	38 -- -- -- -- -- -- -- --	Red pine, jack pine.
OtB Otisco	4W	Slight	Severe	Moderate	Severe	Quaking aspen Yellow birch Balsam fir White spruce Red maple American elm Bigtooth aspen Jack pine	60 -- -- -- -- -- 65 53	64 -- -- -- -- -- 73 73	White spruce, northern whitecedar, eastern white pine.
Rc Roscommon	6W	Slight	Severe	Severe	Severe	Quaking aspen Black spruce Northern whitecedar Jack pine Balsam fir Red maple Yellow birch	74 -- -- -- -- -- --	86 -- -- -- -- -- --	Black spruce, northern whitecedar, tamarack.
RkB**: Roscommon	6W	Slight	Severe	Severe	Severe	Quaking aspen Black spruce Northern whitecedar Jack pine Balsam fir Red maple Yellow birch	74 -- -- -- -- -- --	86 -- -- -- -- -- --	Black spruce, northern whitecedar, tamarack.

* Volume class is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 2.—WOODLAND MANAGEMENT AND PRODUCTIVITY—Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
RkB**: Kalkaska	3S	Slight	Moderate	Moderate	Slight	Sugar maple Quaking aspen Red pine Eastern white pine American beech Paper birch Northern red oak Red maple Bigtooth aspen	64 — — — — — — 63 80	40 — — — — — — 39 94	Red pine, eastern white pine.
RuB, RuD Rubicon	4S	Slight	Moderate	Moderate	Slight	Quaking aspen Jack pine Red pine Bigtooth aspen Northern red oak Red maple Paper birch Eastern white pine	60 53 53 66 — 57 — 45	64 73 82 75 — 36 — 75	Red pine, jack pine, eastern white pine.
RuE Rubicon	4R	Moderate	Moderate	Moderate	Slight	Quaking aspen Jack pine Red pine Bigtooth aspen Northern red oak Red maple Paper birch Eastern white pine	60 53 53 66 — 57 — 45	64 73 87 75 — 36 — 75	Red pine, jack pine, eastern white pine.
ShB Shelldrake	6S	Slight	Moderate	Moderate	Slight	Red pine Eastern white pine Paper birch Quaking aspen Northern pin oak Jack pine Red maple	54 — — — — — —	85 — — — — — —	Red pine, eastern white pine, jack pine, green ash.
SkB Skaneec	3W	Slight	Severe	Moderate	Severe	Red maple Sugar maple Yellow birch Eastern hemlock Balsam fir Quaking aspen Paper birch Northern whitecedar	60 60 — — — — — —	38 38 — — — — — —	White spruce, eastern white pine.
StB, StD Steuben	3D	Slight	Moderate	Slight	Moderate	Sugar maple Quaking aspen Yellow birch Eastern hemlock American basswood Paper birch Balsam fir Black cherry	61 — — — — — — —	38 — — — — — — —	Red pine, Norway spruce, eastern white pine, Carolina poplar, green ash.
SvA Sundell	2W	Slight	Severe	Moderate	Severe	Red maple Paper birch Balsam fir Quaking aspen Northern whitecedar Balsam poplar	55 — — — — —	35 — — — — —	White spruce, Norway spruce.

* Volume class is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 2.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
SwA----- Sundell Variant	6W	Slight	Severe	Moderate	Moderate	Quaking aspen----- Red maple----- Paper birch----- Balsam fir----- Eastern hemlock-----	75 72 63 -- --	87 44 70 -- --	White spruce, Norway spruce, eastern white pine.
Ta----- Tawas	5W	Slight	Severe	Severe	Severe	Balsam fir----- Northern whitecedar- Quaking aspen----- Black ash----- Red maple-----	40 -- -- -- --	71 -- -- -- --	
TrB, TrD----- Trenary	3L	Slight	Moderate	Slight	Slight	Sugar maple----- American basswood----- Yellow birch----- American beech----- Quaking aspen----- Balsam fir----- Eastern hemlock-----	61 65 61 -- -- -- --	38 40 38 -- -- -- --	White spruce, red pine, eastern white pine.
WaA----- Wainola	6W	Slight	Severe	Moderate	Severe	Quaking aspen----- White ash----- Red maple----- Paper birch-----	75 68 72 63	86 63 44 70	White spruce, Norway spruce, eastern white pine.
YaB, YaD----- Yalmer	3D	Slight	Moderate	Moderate	Moderate	Sugar maple----- American beech----- Yellow birch----- Balsam fir----- Eastern hemlock----- Red maple----- Paper birch----- Quaking aspen-----	61 -- -- -- -- 61 -- --	38 -- -- -- -- 38 -- --	Red pine, Norway spruce, European larch.

* Volume class is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 3.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Ad* Alluvial land										
AsA----- Assinins	Fair	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
AuB----- Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
BIB----- Blue Lake	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BID----- Blue Lake	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BIE----- Blue Lake	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
BoB----- Bohemian	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BoD----- Bohemian	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Bp* Borrow pits										
Bs----- Brevort	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
BtA----- Brimley	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Bu----- Bruce Variant	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
BwC----- Burt	Very poor.	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Poor.
Cb*: Carbondale-----	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Lupton-----	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Rifle-----	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Ck*: Cathro-----	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Tacoosh-----	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
CmD----- Chatham	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 3.--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
Cn----- Chippeny	Very poor.	Poor	Poor	Poor	Poor	Good	Fair	Poor	Poor	Fair.
CrA----- Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Dd*: Dawson-----	Very poor.	Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Fair.
Greenwood-----	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
DeB----- Deerton	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
DeD----- Deerton	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
DIB*: Deerton-----	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Burt-----	Very poor.	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Poor.
Dn*, DnG*----- Duneland	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
EcB, EcD----- Adams	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
EkB*: Adams-----	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Kalkaska-----	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
EkD*: Adams-----	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Kalkaska-----	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
EkE*: Adams-----	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Kalkaska-----	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Es*: Ensley-----	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Angelica-----	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Gw----- Greenwood	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 3.--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
HaB----- Halfaday	Fair	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
IoB----- Iosco	Fair	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
Jb*: Jacobsville-----	Poor	Fair	Fair	Fair	Fair	Good	Fair	Poor	Fair	Fair.
Burt-----	Very poor.	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Poor.
KaB----- Kalkaska	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
KaD----- Kalkaska	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
KaE----- Kalkaska	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
KaG----- Kalkaksa	Very poor.	Very poor.	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
KdB, KdD----- Karlin	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
KdE----- Karlin	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
KgC----- Kawbawgam	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
KmB*: Kalkaska-----	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Munising-----	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
KmD*: Kalkaska-----	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Munusing-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
KmE*: Kalkaska-----	Very poor.	Very poor.	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Munusing-----	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
KnB----- Keweenaw	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
KnD----- Keweenaw	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Kr----- Kinross	Very poor.	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Fair	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 3.--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
Lb*. Lake beaches										
McB----- Mancelona	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Mh*. Marsh										
MuB----- Munising	Good	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
MuD----- Munising	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
MuE----- Munising	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Nh----- Nahma	Very poor.	Fair	Fair	Fair	Fair	Good	Good	Poor	Fair	Fair.
OoE*: Onota-----	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Chippeny-----	Very poor.	Poor	Poor	Poor	Poor	Good	Fair	Poor	Poor	Fair.
OrB*: Onota-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Deerton-----	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
OrD*: Onota-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Deerton-----	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
OtB----- Otisco	Fair	Good	Good	Fair	Good	Poor	Very poor.	Good	Fair	Very poor.
Rc----- Roscommon	Poor	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good.
RkB*: Roscommon-----	Poor	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good.
Kalkaska-----	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
RuB----- Rubicon	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
RuD----- Rubicon	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
RuE----- Rubicon	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 3.--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
ShB----- Shelldrake	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
SkB----- Skaneec	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
StB----- Steuben	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
StD----- Steuben	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
SvA----- Sundell	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SwA----- Sundell Variant	Fair	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
Ta----- Tawas	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
TrB----- Trenary	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
TrD----- Trenary	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
WaA----- Wainola	Fair	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
YaB----- Yalmer	Fair	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
YaD----- Yalmer	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 4.--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
Ad* Alluvial land	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.
AsA Assinins	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
AuB Au Gres	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
BIB Blue Lake	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
BID Blue Lake	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
BIE Blue Lake	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
BoB Bohemian	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
BoD Bohemian	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
Bp* Borrow pits				
Bs Brevort	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus	Severe: ponding, excess humus.
BtA Brimley	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
Bu Bruce Variant	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
BwC Burt	Severe: ponding, depth to rock.	Severe: ponding, depth to rock.	Severe: ponding, depth to rock.	Severe: ponding.
Cb* Carbondale	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
Lupton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 4.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Cb*: Rifle	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
Ck*: Cathro	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
Tacoosh	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
CmD Chatham	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Cn Chippeny	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
CrA Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Dd*: Dawson	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
Greenwood	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
DeB Deerton	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
DeD Deerton	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
DIB*: Deerton	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Burt	Severe: ponding, depth to rock.	Severe: ponding, depth to rock.	Severe: ponding, depth to rock.	Severe: ponding.
Dn* Duneland	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
DnG* Duneland	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
EcB Adams	Slight	Slight	Moderate: slope.	Slight.
EcD Adams	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 4.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
EkB*: Adams	Slight	Slight	Moderate: slope.	Slight.
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
EkD*: Adams	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
EkE*: Adams	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kalkaska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
Es*: Ensley	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Angelica	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Gw Greenwood	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
HaB Halfaday	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
IoB Iosco	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
Jb*: Jacobsville	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
Burt	Severe: ponding, depth to rock.	Severe: ponding, depth to rock.	Severe: ponding, depth to rock.	Severe: ponding.
KaB Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
KaD Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
KaE Kalkaska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 4.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
KaG----- Kalkaksa	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
KdB----- Karlin	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.
KdD----- Karlin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
KdE----- Karlin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
KgC----- Kawbawgam	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
KmB*: Kalkaska-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Munising-----	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness, percs slowly.	Moderate: wetness.
KmD*: Kalkaska-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Munising-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
KmE*: Kalkaska-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
Munising-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
KnB----- Keweenaw	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.
KnD----- Keweenaw	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Kr----- Kinross	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Lb*. Lake beaches				
McB----- Mancelona	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 4.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Mh* Marsh				
MuB----- Munising	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.
MuD----- Munising	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness, percs slowly.	Moderate: wetness.
MuE----- Munising	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Nh----- Nahma	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
OoE*: Onota-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Chippeny-----	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
OrB*: Onota-----	Slight-----	Slight-----	Moderate: slope, depth to rock.	Slight.
Deerton-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
OrD*: Onota-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Deerton-----	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
OtB----- Otisco	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Rc----- Roscommon	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
RkB*: Roscommon-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Kalkaska-----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
RuB----- Rubicon	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 4.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
RuD----- Rubicon	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
RuE----- Rubicon	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
ShB----- Shelldrake	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
SkB----- Skanee	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.
StB----- Steuben	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
StD----- Steuben	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.
SvA----- Sundell	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
SwA----- Sundell Variant	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.
Ta----- Tawas	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
TrB----- Trenary	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.
TrD----- Trenary	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
WaA----- Wainola	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
YaB----- Yalmer	Severe: percs slowly, too sandy.	Severe: too sandy, percs slowly.	Severe: too sandy, percs slowly.	Severe: too sandy.
YaD----- Yalmer	Severe: percs slowly, too sandy.	Severe: too sandy, percs slowly.	Severe: slope, too sandy, percs slowly.	Severe: too sandy.
* Water				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--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		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
Ad* Alluvial land	0-60	Variable	--	--	--	--	--	--	--	--	--
AsA Assinins	0-22	Sand	SM, SP-SM	A-2, A-3	0-5	95-100	85-100	50-70	5-30	--	NP
	22-31	Sandy loam, sandy clay loam.	SC, SM, ML, CL	A-2, A-4	0-5	95-100	85-100	60-90	25-55	<25	NP-10
	31-60	Sandy loam, fine sandy loam.	SM, SC-SM	A-2, A-4	0-5	95-100	85-100	50-85	25-50	<20	NP-5
AuB Au Gres	0-8	Sand	SM, SP-SM, SP	A-2-4, A-3, A-1-B	0	95-100	75-100	35-70	0-15	--	NP
	8-27	Sand	SP-SM, SM, SP	A-2-4, A-3, A-1-B	0	95-100	75-100	35-75	0-15	<25	NP
	27-60	Sand	SP-SM, SM, SP	A-3, A-2-4, A-1-B	0	95-100	75-100	35-70	0-15	--	NP
BIB, BID, BIE Blue Lake	0-10	Sand	SM, SP-SM	A-2-4, A-3, A-1-B	0-5	95-100	85-100	40-70	5-15	--	NP
	10-25	Loamy sand, sand	SP-SM, SM	A-2-4, A-3, A-1-B	0-5	95-100	85-100	40-75	5-30	--	NP
	25-32	Stratified sand to sandy loam.	SP-SM, SM	A-2-4, A-4, A-3, A-1-B	0-5	95-100	85-100	40-75	5-40	--	NP
	32-60	Sand	SP-SM, SM	A-3, A-2-4, A-1-B	0-5	95-100	85-100	40-75	5-15	--	NP
BoB, BoD Bohemian	0-5	Fine sandy loam	ML, SM, SC-SM, CL-ML	A-4	0	100	100	70-95	45-65	<25	NP-7
	5-17	Very fine sandy loam, fine sandy loam, silt loam.	ML, CL, CL-ML	A-4	0	100	100	70-95	50-90	<30	NP-10
	17-31	Fine sandy loam, silt loam, loam.	CL	A-4, A-6	0	100	100	70-95	50-90	25-35	9-15
	31-60	Stratified very fine sand to clay.	CL-ML, CL	A-4, A-6	0	100	100	70-95	50-90	20-40	4-20
Bp* Borrow pits											
Bs Brevort	0-8	Muck	PT	A-8	0	--	--	--	--	--	--
	8-30	Sand, loamy sand.	SC-SM, SM, SP-SM, SC-SM	A-2-4, A-3, A-1-B	0-8	85-100	75-100	35-85	5-35	<20	NP-7
	30-60	Loam, silt loam.	CL, CL-ML, SC, SC-SM	A-4, A-6, A-7, A-2 A-7, A-2	0-8	100	95-100	75-100	50-85	20-35	5-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--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	
BtA----- Brimley	0-8	Fine sandy loam	SM, ML, SC, CL	A-4, A-6	0	100	100	70-95	40-65	20-30	3-11
	8-17	Very fine sandy, silt loam.	SC, SM, CL, ML	A-4, A-6	0	100	100	70-95	40-90	20-30	3-11
	17-22	Silty clay loam, silt loam.	CL, SC	A-4, A-6, A-7	0	100	100	95-100	85-95	25-45	9-20
	22-60	Stratified very fine sand to silt loam.	ML, SM, SC, CL	A-4, A-6	0	100	100	70-95	40-90	20-40	3-18
Bu----- Bruce Variant	0-5	Muck-----	PT	A-8	0	--	--	--	--	--	--
	5-15	Very fine sandy loam, loamy very fine sand.	SM, ML	A-4	0	100	100	70-95	40-65	<20	NP-4
	15-60	Stratified very fine sand to silt.	SM, ML	A-4, A-2-4	0	100	100	55-95	30-95	<20	NP-4
BwC----- Burt	0-5	Mucky sandy loam	SM	A-2-4	0-10	95-100	85-100	50-70	25-35	<20	NP-4
	5-17	Sand, loamy sand, fine sand.	SP-SM, SM	A-3, A-2, A-1-B	0-10	95-100	85-100	40-75	5-30	--	NP
	17	Unweathered bedrock.	--	--	--	--	--	--	--	--	--
Cb*: Carbondale-----	0-4	Mucky-peat-----	PT	A-8	0	--	--	--	--	--	--
	4-32	Muck-----	PT	A-8	0	--	--	--	--	--	--
	32-60	Mucky-peat-----	PT	A-8	0	--	--	--	--	--	--
Lupton-----	0-46	Muck-----	PT	A-8	0	--	--	--	--	--	--
	46-60	Muck-----	PT	A-8	0	--	--	--	--	--	--
Rifle-----	0-4	Peat-----	PT	A-8	0	--	--	--	--	--	--
	4-60	Mucky-peat-----	PT	A-8	0	--	--	--	--	--	--
Ck*: Cathro-----	0-11	Muck-----	PT	A-8	0	--	--	--	--	--	--
	11-23	Muck-----	PT	A-8	0	--	--	--	--	--	--
	23-60	Loam, clay loam sandy loam.	SC-SM, CL-ML, SC, CL	A-4, A-6	0-5	95-100	85-100	55-100	25-75	25-40	7-15
Tacoosh-----	0-8	Muck-----	PT	A-8	0-10	--	--	--	--	--	--
	8-40	Mucky peat-----	PT	A-8	0-10	--	--	--	--	--	--
	40-60	Sandy loam, loam, very fine sandy loam.	SM, ML, SC, CL	A-2, A-4, A-6	0-10	85-100	85-95	65-95	25-75	15-35	NP-20
CmD----- Chatham	0-13	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4, A-2	0-15	90-100	85-100	60-85	30-55	<25	NP-7
	13-23	Sandy loam, fine sandy loam, loam.	SM, SC, SC-SM, ML	A-2-4, A-4	0-15	90-100	85-100	50-90	25-70	<25	NP-10
	23-60	Gravelly loamy sand, gravelly sandy loam.	SM, SP-SM	A-1, A-3, A-2-4	30-70	80-90	50-70	30-65	15-25	--	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
Cn Chippeny	0-20	Muck	PT	—	—	—	—	—	—	—	—
	20-28	Silty clay loam, loamy sand.	SC-SM, CL-ML, GM-GC	A-2, A-4, A-6, A-1-A	0-30	45-100	75-100	20-100	10-90	<50	NP-30
	28	Unweathered bedrock.	—	—	—	—	—	—	—	—	—
CrA Croswell	0-5	Sand	SP-SM, SM	A-3, A-2-4, A-1-B	0	90-100	75-100	40-70	5-15	—	NP
	5-28	Sand	SP-SM, SM, SP	A-3, A-2-4, A-1-B	0	90-100	75-100	40-75	3-15	—	NP
	28-60	Sand	SP-SM, SM, SP	A-3, A-2-4, A-1-B	0	90-100	75-100	40-70	3-15	—	NP
Dd*: Dawson	0-8	Peat	PT	A-8	0	—	—	—	—	—	—
	8-38	Muck	PT	A-8	0	—	—	—	—	—	—
	38-40	Silt loam	ML, CL-ML, SM	A-4, A-1-B, A-2-4	0	100	100	90-100	75-90	20-40	5-10
	40-60	Sand	SP, SM, SP-SM	A-3, A-2-4, A-1-B	0	95-100	75-100	30-75	0-15	—	NP
Greenwood	0-10	Peat	PT	A-8	0	—	—	—	—	—	—
	10-60	Mucky-peat	PT	A-8	0	—	—	—	—	—	—
DeB, DeD Deerton	0-8	Sand	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	90-100	45-70	5-15	—	NP
	8-24	Sand, loamy sand	SM, SP, SP-SM	A-1-B, A-2-4, A-3	0-10	85-100	80-95	40-75	4-30	—	NP
	24-38	Weathered bedrock	—	—	—	—	—	—	—	—	—
	38	Unweathered bedrock.	—	—	—	—	—	—	—	—	—
DiB*: Deerton	0-8	Sand	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	90-100	45-70	5-15	—	NP
	8-24	Sand, loamy sand	SM, SP, SP-SM	A-1-B, A-2-4, A-3	0-10	85-100	80-95	40-75	4-30	—	NP
	24-38	Weathered bedrock	—	—	—	—	—	—	—	—	—
	38	Unweathered bedrock.	—	—	—	—	—	—	—	—	—
Burt	0-5	Mucky loamy sand	SP-SM, SM	A-2-4, A-1-B	0-10	95-100	85-100	40-75	10-30	—	NP
	5-17	Sand, loamy sand, fine sand.	SP-SM, SM	A-3, A-2, A-1-B	0-10	95-100	85-100	40-75	5-30	—	NP
	17	Unweathered bedrock.	—	—	—	—	—	—	—	—	—

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Dn*, DnG* Duneland	0-60	Fine sand	SM	A-2-4	0	100	100	50-100	20-35	<20	NP
EcB, EcD Adams	0-5	Loamy sand	SM, SP-SM	A-1, A-2, A-3, A-4	0	95-100	95-100	45-85	5-40	--	NP
	5-26	Loamy sand	SM, SP-SM	A-1, A-2, A-3, A-4	0	95-100	95-100	45-85	5-40	--	NP
	26-60	Coarse sand, gravelly sand.	SP-SM, SW-SM, SP	A-1, A-2, A-3	0-1	80-100	70-100	20-90	0-10	--	NP
EkB*, EkD*, EkE* Adams	0-5	Loamy sand	SM, SP-SM	A-1, A-2, A-3, A-4	0	95-100	95-100	45-85	5-40	--	NP
	5-26	Loamy sand	SM, SP-SM	A-1, A-2, A-3, A-4	0	95-100	95-100	45-85	5-40	--	NP
	26-60	Coarse sand, gravelly sand.	SP-SM, SW-SM, SP	A-1, A-2, A-3	0-1	80-100	70-100	20-90	0-10	--	NP
Kalkaska	0-10	Sand	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-70	5-15	--	NP
	10-13	Sand	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-75	5-30	--	NP
	13-27	Sand	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-70	5-15	--	NP
	27-60	Sand	SP, SP-SM, SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-70	0-15	--	NP
Es* Ensley	0-4	Sandy loam	SM, ML	A-2, A-4	0-10	90-100	75-100	45-85	25-60	<30	NP-4
	4-30	Sandy loam, sandy clay loam, fine sandy loam.	SC, SC-SM, CL, CL-ML	A-6, A-4, A-2, A-1	0-10	90-100	75-100	45-90	20-55	20-35	4-15
	30-60	Sandy loam, fine sandy loam.	SC-SM, SM, SC	A-2, A-4, A-1	0-10	95-100	90-100	45-85	25-50	<30	2-9
Angelica	0-6	Loam	ML	A-4, A-6	0-10	90-100	85-100	80-100	55-90	25-40	2-13
	6-14	Loam, sandy loam, clay loam.	SM, ML, SC, CL	A-4, A-6	0-10	90-100	85-100	50-90	36-90	12-40	2-20
	14-17	Sandy loam, loam, silt loam.	SC, CL, SC-SM, CL-ML	A-2-4, A-6, A-4, A-2-6	0-10	85-100	75-100	60-95	30-75	15-30	0-17
	17-60	Sandy loam, gravelly loam, silt loam.	ML, SM, CL, SC	A-2-4, A-4, A-6, A-2-6	0-15	85-100	80-100	50-100	30-90	20-40	NP-16
Gw Greenwood	0-10	Peat	PT	A-8	0	--	--	--	--	--	--
	10-60	Mucky-peat	PT	A-8	0	--	--	--	--	--	--

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--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		
	ln				Pct					Pct	
HaB Halfaday	0-7	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	40-70	5-15	—	NP
	7-37	Sand	SM, SP-SM	A-1, A-2, A-3	0	95-100	90-100	40-75	5-15	—	NP
	37-60	Sand	SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	40-75	5-15	—	NP
IoB Iosco	0-15	Sand	SM, SP-SM	A-2-4, A-3, A-1-B	0-8	90-100	75-100	35-80	5-35	—	NP
	15-32	Loamy sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-B	0-8	90-100	75-100	35-85	5-35	<25	NP-7
	32-60	Silty clay loam, clay loam, loam.	CL, CL-ML	A-4, A-6, A-7	0-8	90-100	85-100	70-95	50-90	25-45	5-25
Jb* Jacobsville	0-5	Muck	PT	A-8	0	—	—	—	—	—	—
	5-9	Sandy loam, loamy sand.	SM, SC-SM, SP-SM	A-2-4, A-4, A-1-B	0-15	90-100	85-100	40-75	10-40	<25	NP-7
	9-23	Sandy loam	SM, SC-SM	A-2-4, A-4	0-15	90-100	85-100	50-70	25-40	<25	NP-7
	23-36	Sandy loam	SM, SC-SM,	A-2-4, A-4	40-100	85-100	50-70	25-40	5-35	<25	NP-7
	36	Unweathered bedrock.	—	—	—	—	—	—	—	—	—
Burt	0-5	Mucky sandy loam	SM	A-2-4	0-10	95-100	85-100	50-70	25-35	<20	NP-4
	5-17	Sand, loamy sand, fine sand.	SP-SM, SM	A-3, A-2, A-1-B	0-10	95-100	85-100	40-75	5-30	—	NP
	17	Unweathered bedrock.	—	—	—	—	—	—	—	—	—
KaB, KaD, KaE, KaC Kalkaska	0-10	Sand	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-70	5-15	—	NP
	10-13	Sand	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-75	5-30	—	NP
	13-27	Sand	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-70	5-15	—	NP
	27-60	Sand	SP, SP-SM, SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-70	0-15	—	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--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		
KdB, KdD, KdE— Kariin	0-4	Sandy loam—	SM, ML	A-4, A-1, A-2	0	90-100	75-100	45-85	20-55	<20	NP-4
	4-17	Loamy fine sand, loamy sand, sandy loam.	SP-SM, SM, ML	A-2, A-4	0	90-100	75-100	60-100	10-55	<20	NP-4
	17-22	Loamy sand, loamy fine sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	90-100	75-100	35-80	0-35	—	NP
	22-60	Sand—	SP, SP-SM, SM	A-2, A-3, A-1	0	80-100	75-100	35-70	0-15	—	NP
KgC— Kawbawgam	0-6	Sandy loam—	SM, SC-SM	A-4, A-2-4	1-15	90-100	85-100	50-85	25-50	<25	NP-7
	6-24	Sandy loam, fine sandy loam.	SM, SC-SM	A-2-4, A-4	1-15	90-100	85-100	60-90	30-50	<25	NP-7
	24	Unweathered bedrock.	—	—	—	—	—	—	—	—	—
KmB*, KmD*, KmE Kalkaska	* 0-10	Sand—	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-70	5-15	—	NP
	10-13	Sand—	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-75	5-30	—	NP
	13-27	Sand—	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-70	5-15	—	NP
	27-60	Sand—	SP, SP-SM, SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-70	0-15	—	NP
Munising—	0-6	Sandy loam—	SM, SC-SM	A-4, A-2-4	0-8	95-100	85-100	50-85	25-45	<25	NP-6
	6-16	Sandy loam, fine sandy loam.	SM, SC-SM	A-4, A-2-4	0-8	95-100	85-100	50-85	25-50	<25	NP-6
	16-46	Sandy loam, loamy sand, loamy fine sand.	SM, SC, SP-SM, SC-SM	A-2, A-4, A-1-B	0-8	95-100	85-100	40-80	10-40	<30	NP-10
	46-60	Sandy loam, fine sandy loam.	SM, SC-SM	A-4, A-2-4	0-8	95-100	85-100	50-85	25-50	<25	NP-7

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--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	
KnB, KnD Keweenaw	0-8	Loamy sand	SM, SC, SC-SM, SP-SM	A-2, A-1-B, A-4	0-10	90-100	75-100	35-85	10-40	<20	NP-10
	8-29	Loamy fine sand, sand.	SM, SC, SC-SM, SP-SM	A-2, A-1-B, A-4, A-3	0-25	85-100	60-100	30-85	5-45	<20	NP-10
	29-32	Sand, loamy sand.	SM, SC, SP-SM, SC-SM	A-2, A-3, A-1-B, A-4	0-25	95-100	85-100	40-75	5-30	<20	NP-10
	32-39	Fine sandy loam, sandy loam, coarse loamy sand.	SM, SC, SP-SM, SC-SM	A-2, A-3, A-1-B, A-4	0-25	95-100	85-100	40-85	5-30	<30	NP-10
	39-60	Loamy sand, sand.	SM, SC, SC-SM, SP-SM	A-2, A-1-B	0-25	95-100	85-100	40-75	5-30	<20	NP-10
Kr Kinross	0-6	Muck	PT	A-8	0	—	—	—	—	—	NP
	6-42	Sand	SP-SM, SM	A-3, A-2-4	0	100	90-100	50-80	5-30	—	NP
	42-60	Sand	SP-SM, SM	A-3, A-2-4	0	100	90-100	50-80	5-30	—	NP
Lb* Lake beaches											
McB Manuelona	0-8	Loamy sand	SM, SP-SM	A-2, A-1-B	0-15	90-100	75-95	35-80	10-35	—	NP
	8-22	Loamy sand	SM, SP-SM	A-2	0-15	90-100	75-95	35-80	10-35	—	NP
	22-26	Gravelly 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
	26-60	Gravelly sand, sand.	GP, SP, GW, SW	A-1, A-2, A-3	0-15	40-80	35-70	20-45	0-10	—	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--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		
Mh* Marsh	In				Pct					Pct	
MuB, MuD, MuE- Munising	0-6	Sandy loam	SM, SC-SM	A-4, A-2-4	0-8	95-100	85-100	50-85	25-45	<25	NP-6
	6-16	Sandy loam, fine sandy loam.	SM, SC-SM	A-4, A-2-4	0-8	95-100	85-100	50-85	25-50	<25	NP-6
	16-46	Sandy loam, loamy sand.	SM, SC, SP-SM, SC-SM	A-2, A-4, A-1-B	0-8	95-100	85-100	40-80	10-40	<30	NP-10
	46-60	Sandy loam	SM, SC-SM	A-4, A-2-4	0-8	95-100	85-100	50-85	25-50	<25	NP-7
Nh Nahma	0-4	Muck	PT	A-8	0	--	--	--	--	--	--
	4-13	Sandy loam, loam.	SM, ML, CL, SC	A-4, A-2	0-20	80-100	80-95	45-90	25-75	15-25	2-9
	13-33	Sandy loam, loam, gravelly fine sandy loam.	SM, ML, CL, SC	A-4, A-2, A-1-B	0-20	90-100	75-100	45-95	20-75	20-30	2-9
	33	Unweathered bedrock.	--	--	--	--	--	--	--	--	--
OoE*: Onota	0-7	Sandy loam	SM, SC-SM	A-2, A-4	0-10	95-100	90-100	55-70	25-40	<25	2-7
	7-24	Sandy loam	SM, SC-SM, SC	A-2, A-4, A-6	0-10	95-100	90-100	55-70	25-40	<25	2-11
	24-28	Loamy sand, sandy loam.	SM, SC, SC-SM, SP-SM	A-2, A-4, A-1	0-10	95-100	90-100	45-75	10-40	<25	NP-10
	28-31	Weathered bedrock	--	--	--	--	--	--	--	--	--
	31	Unweathered bedrock.	--	--	--	--	--	--	--	--	--
Chippeny	0-20	Muck	PT	--	--	--	--	--	--	--	--
	20-28	Silty clay loam, loamy sand, sandy loam.	SC-SM, CL-ML	A-2, A-4, A-6, A-1-A	0-30	45-100	75-100	20-100	10-90	<50	NP-30
	28	Unweathered bedrock.	--	--	--	--	--	--	--	--	--
OrB*, OrD*: Onota	0-7	Sandy loam	SM, SC-SM	A-2, A-4	0-10	95-100	90-100	55-70	25-40	<25	2-7
	7-24	Sandy loam	SM, SC-SM, SC	A-2, A-4, A-6	0-10	95-100	90-100	55-70	25-40	<25	2-11
	24-28	Loamy sand, sandy loam.	SM, SC, SC-SM, SP-SM	A-2, A-4, A-1	0-10	95-100	90-100	45-75	10-40	<25	NP-10
	28-31	Weathered bedrock	--	--	--	--	--	--	--	--	--
	31	Unweathered bedrock.	--	--	--	--	--	--	--	--	--
Deerton	0-8	Loamy sand	SM, SP-SM	A-1-B, A-2-4	0-5	95-100	90-100	45-70	10-30	--	NP
	8-24	Sand, loamy sand	SM, SP, SP-SM	A-1-B, A-2-4, A-3	0-10	85-100	80-95	40-75	4-30	--	NP
	24-38	Weathered bedrock	--	--	--	--	--	--	--	--	--
	38	Unweathered bedrock.	--	--	--	--	--	--	--	--	--

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--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		
OtB----- Otisco	0-9	Loamy sand-----	SM, SP-SM, SC-SM	A-2, A-1-B	0	95-100	90-100	45-75	10-30	<20	NP-5
	9-29	Loamy sand, sand	SM, SP-SM, SC-SM	A-2, A-3, A-1-B	0	95-100	90-100	45-75	5-30	<20	NP-5
	29-41	Loamy sand, very fine sandy loam.	SM, SP-SM, CL, SC	A-2, A-4, A-3, A-6	0	95-100	90-100	45-90	5-55	<30	NP-15
	41-60	Sand-----	SM, SP-SM, SC-SM	A-2, A-3, A-1-B	0	95-100	90-100	45-75	5-30	<20	NP-5
Rc----- Roscommon	0-4	Muck-----	PT	A-8	0	---	---	---	---	---	---
	4-60	Sand-----,	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-75	0-30	<20	NP-4
RkB*: Roscommon-----	0-4	Muck-----	PT	A-8	0	---	---	---	---	---	---
	4-60	Sand, loamy sand, coarse sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-75	0-30	<20	NP-4
Kalkaska-----	0-10	Sand-----	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-70	5-15	---	NP
	10-13	Sand-----	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-75	5-30	---	NP
	13-27	Sand-----	SM, SP-SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-70	5-15	---	NP
	27-60	Sand-----	SP, SP-SM, SM	A-1-B, A-2-4, A-3	0-5	95-100	85-100	45-70	0-15	---	NP
RuB, RuD, RuE--- Rubicon	0-4	Sand-----	SM, SP-SM, SP	A-2, A-3, A-1	0	95-100	75-100	35-70	0-15	---	NP
	4-27	Sand-----	SM, SP-SM, SP	A-2, A-3, A-1	0	95-100	75-100	35-70	0-15	---	NP
	27-60	Sand-----	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	75-100	30-70	0-15	---	NP
ShB----- Sheldrake	0-60	Sand-----	SP, SP-SM	A-1, A-3, A-2	0	100	90-100	40-55	0-10	---	NP
SkB----- Skaneec	0-8	Sandy loam-----	SM, SC-SM, SC	A-2, A-4	0-4	95-100	85-100	45-85	25-50	<28	NP-10
	8-17	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2, A-4	0-4	95-100	85-100	55-85	25-50	<28	2-10
	17-36	Sandy loam, loamy sand, sandy clay loam.	SC, CL, SP-SC	A-2, A-4, A-6	0-4	95-100	85-100	40-90	10-55	25-35	7-15
	36-60	Sandy loam-----	SM, SC-SM, SC	A-2, A-4	0-4	95-100	85-100	50-70	25-40	<25	3-8
StB, StD----- Steuben	0-8	Fine sandy loam	SM, ML	A-4, A-2-4	0-3	95-100	95-100	55-85	25-55	---	NP
	8-21	Fine sandy loam, sandy loam.	SM, ML, CL, SC	A-4, A-2-4	0-3	95-100	95-100	55-85	25-55	<25	NP-10
	21-40	Loamy sand, fine sandy loam, sandy clay loam.	SC, CL, SC-SM, CL-ML	A-2-4, A-4, A-1-B	0-3	95-100	95-100	45-75	10-55	<30	5-10
	40-60	Sand, coarse sand	SM, SP-SM	A-3, A-2-4	0	100	95-100	50-70	5-15	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
SvA----- Sundell	In				Pct					Pct	
	0-8	Fine sandy loam	SM, SC, SC-SM, ML	A-2, A-4	0-4	95-100	95-100	55-95	25-55	<20	2-9
	8-23	Sandy loam, loam, fine sandy loam.	SM, ML, CL, SC	A-2, A-4	0-4	95-100	95-100	65-95	25-75	<20	2-9
	23-26	Loam, fine sandy loam.	SM, ML, CL, SC	A-2, A-4	0-4	95-100	95-100	55-95	25-75	15-30	2-10
	26	Unweathered bedrock.	--	--	--	--	--	--	--	--	--
SwA----- Sundell Variant	0-11	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	100	100	90-95	30-50	<25	NP-7
	11-29	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	100	100	90-95	30-50	<25	NP-7
	29-35	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	100	100	90-95	30-50	<25	NP-7
	35	Unweathered bedrock.	--	--	--	--	--	--	--	--	--
Ta----- Tawas	0-4	Mucky-peat-----	PT	A-8	0	--	--	--	--	--	--
	4-18	Muck-----	PT	A-8	0	--	--	--	--	--	--
	18-60	Sand-----	SP, SM, SP-SM	A-3, A-2-4, A-4	0	80-100	60-100	30-80	0-40	--	NP
TrB, TrD----- Trenary	0-6	Fine sandy loam	SM, SC-SM	A-2, A-4	0-8	95-100	85-100	55-85	30-50	<25	NP-7
	6-17	Fine sandy loam--	SM, ML, CL-ML, SC-SM	A-4	0-8	95-100	85-100	65-95	25-65	<25	NP-7
	17-26	Sandy loam, loamy sand.	SM, SC-SM, SP-SM	A-2, A-4, A-1	0-8	95-100	85-100	45-70	10-40	<25	NP-7
	26-37	Loam, sandy clay loam.	SC, CL	A-2, A-4, A-6	0-8	85-100	75-100	65-100	50-80	25-40	10-15
	37-60	Sandy loam, loam, fine sandy loam.	SM, ML, CL, SC	A-2, A-4	0-8	95-100	85-100	55-90	25-75	<30	NP-10
WaA----- Wainola	0-11	Fine sand-----	SM	A-2-4	0	100	90-100	60-80	15-35	--	NP
	11-26	Fine sand, loamy fine sand.	SM, ML	A-2-4, A-4	0	100	90-100	50-80	15-55	--	NP
	26-60	Fine sand, loamy fine sand.	SM, ML	A-2-4, A-4	0	100	90-100	50-80	15-55	--	NP
YaB, YaD----- Yalmer	0-9	Sand-----	SP-SM, SM	A-1, A-2, A-3	0-2	95-100	75-100	35-85	5-30	--	NP
	9-26	Loamy sand, sand.	SP-SM, SM	A-2, A-1-B	0-2	95-100	75-100	35-85	10-30	<20	NP-4
	26-38	Loamy sand, fine sand, fine sandy loam.	SM, SC-SM, SP-SM	A-2, A-1-B, A-4	0-6	95-100	75-100	40-85	10-50	<25	NP-7
	38-43	Fine sandy loam, sandy loam.	SM, SC, SC-SM	A-2, A-4, A-1-B	0-6	95-100	75-100	45-85	20-50	<25	NP-8
	43-60	Sandy loam, fine sandy loam.	SM, SC, SC-SM	A-2, A-4, A-1-B	0-6	95-100	75-100	45-85	20-50	<25	NP-8

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cc	In/hr	In/in	pH					Pct
Ad* Alluvial land	0-60	—	—	—	—	—	—	—	—	—	—
AsA Assinins	0-22 22-31 31-60	0-10 5-18 5-18	1.25-1.60 1.50-1.90 1.50-1.90	6.0-20 0.2-2.0 0.6-2.0	0.07-0.09 0.10-0.13 0.10-0.16	4.5-6.0 5.1-6.0 4.5-6.0	Low Low Low	0.15 0.37 0.24	4	1	1-3
AuB Au Gres	0-8 8-27 27-60	0-8 1-8 0-8	1.30-1.55 1.50-1.70 1.50-1.70	6.0-20 6.0-20 6.0-20	0.07-0.10 0.06-0.09 0.05-0.07	4.5-6.0 4.5-6.0 5.1-7.3	Low Low Low	0.10 0.10 0.10	5	1	2-4
BIB, BID, BIE Blue Lake	0-10 10-25 25-32 32-60	0-5 5-12 8-15 0-5	1.35-1.60 1.30-1.60 1.30-1.60 1.45-1.70	6.0-20 6.0-20 2.0-6.0 6.0-20	0.07-0.09 0.06-0.11 0.06-0.12 0.05-0.07	5.1-6.0 5.1-6.0 5.1-6.0 5.6-7.8	Low Low Low Low	0.15 0.17 0.17 0.17	5	1	5-2
BoB, BoD Bohemian	0-5 5-17 17-31 31-60	5-15 10-18 18-25 10-35	1.30-1.65 1.30-1.65 1.30-1.70 1.35-1.65	0.6-2.0 0.6-2.0 0.2-0.6 0.2-0.6	0.16-0.20 0.15-0.20 0.15-0.20 0.17-0.20	5.1-6.5 5.1-6.5 5.6-7.3 6.6-8.4	Low Low Low Low	0.24 0.43 0.43 0.37	5	3	1-3
Bp* Borrow pits											
Bs Brevort	0-8 8-30 30-60	— 2-15 10-28	0.30-0.40 1.40-1.55 1.45-1.80	2.0-6.0 2.0-2.0 0.2-0.6	0.35-0.45 0.05-0.11 0.14-0.22	6.1-7.3 6.1-7.3 7.4-8.4	— Low Moderate	— 0.17 0.43	5	2	60-70
BtA Brimley	0-8 8-17 17-22 22-60	10-20 10-20 18-35 10-27	1.35-1.50 1.45-1.70 1.45-1.70 1.45-1.70	0.6-2.0 0.6-2.0 0.2-0.6 0.2-0.6	0.16-0.22 0.16-0.24 0.17-0.22 0.10-0.22	5.6-7.3 5.6-7.3 5.6-7.3 7.4-8.4	Low Low Low Low	0.32 0.32 0.43 0.43	5	3	1-3
Bu Bruce Variant	0-5 5-15 15-60	— 5-10 2-10	0.30-0.40 1.45-1.60 1.55-1.70	2.0-6.0 0.6-2.0 0.6-2.0	0.35-0.45 0.14-0.19 0.06-0.20	6.1-7.3 6.6-7.3 6.6-8.4	— Low Low	— 0.43 0.37	5	2	60-70
BwC Burt	0-5 5-17 17	2-10 0-8 —	1.30-1.60 1.30-1.60 —	2.0-6.0 6.0-2.0 0.2-2.0	0.14-0.17 0.04-0.08 —	4.5-6.5 4.5-6.5 —	Low Low —	0.24 0.15 —	2	3	10-20
Cb* Carbondale	0-4 4-32 32-60	— — —	0.30-0.40 0.13-0.23 0.10-0.17	0.6-6.0 0.2-6.0 0.6-6.0	0.45-0.55 0.35-0.45 0.45-0.55	5.1-7.8 5.1-7.8 5.6-7.8	— — —	— — —	5	5	50-70
Lupton	0-46 46-60	— —	0.10-0.35 0.10-0.35	0.2-6.0 0.2-6.0	0.35-0.45 0.35-0.45	5.6-7.8 5.6-7.8	— —	— —	5	2	70-90
Rifle	0-4 4-60	— —	0.20-0.35 0.08-0.20	>6.0 0.6-6.0	0.55-0.65 0.45-0.55	5.6-7.3 5.6-7.3	— —	— —	5	7	70-90
Ck* Cathro	0-11 11-23 23-60	— — 10-30	0.28-0.45 0.15-0.30 1.50-1.70	0.2-6.0 0.2-6.0 0.2-2.0	0.45-0.55 0.35-0.45 0.11-0.22	6.5-7.8 6.5-7.8 7.3-8.4	— — Low	— — 0.32	5	2	60-85

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	<u>In</u>	<u>Pct</u>	<u>G/cc</u>	<u>In/hr</u>	<u>In/in</u>	<u>pH</u>					<u>Pct</u>
Ck*: Tacoosh	0-8 8-40 40-60	— — 5-28	0.10-0.30 0.10-0.20 1.40-2.00	0.2-6.0 0.6-6.0 0.2-2.0	0.35-0.45 0.45-0.55 0.12-0.20	5.6-7.8 5.6-7.8 5.6-8.4	— — Low	— — 0.32	5	2	>75
CmD Chatham	0-13 13-23 23-60	2-15 5-18 0-10	1.10-1.60 1.25-1.70 1.50-1.70	2.0-6.0 2.0-6.0 2.0-6.0	0.13-0.17 0.10-0.14 0.02-0.05	6.1-7.8 6.1-7.8 7.4-8.4	Low Low Low	0.24 0.24 0.10	4	3	1-3
Cn Chippeny	0-20 20-28 28	— 5-45 —	0.15-0.30 1.45-1.75 —	0.2-0.6 0.06-2.0 0.06-0.6	0.35-0.45 0.04-0.19 —	5.6-7.8 6.6-8.4 —	— Low —	— — —	4	2	55-75
CrA Croswell	0-5 5-28 28-60	0-10 0-10 0-10	1.30-1.55 1.40-1.60 1.50-1.65	6.0-20 6.0-20 6.0-20	0.06-0.09 0.06-0.10 0.05-0.07	4.5-6.0 4.5-6.0 5.6-6.5	Low Low Low	0.15 0.15 0.15	5	1	.5-2
Dd*: Dawson	0-8 8-38 38-40 40-60	— — 10-15 0-10	0.15-0.30 0.15-0.40 1.55-1.75 1.55-1.75	>6.0 0.2-6.0 0.6-2.0 6.0-20	0.55-0.65 0.35-0.45 0.18-0.20 0.03-0.10	3.6-4.4 3.6-4.4 3.6-4.4 4.5-6.5	— — Low Low	— — 0.24 0.10	4	7	65-85
Greenwood	0-10 10-60	— —	0.30-0.40 0.10-0.25	>6.0 0.6-6.0	0.55-0.65 0.45-0.55	3.6-4.4 3.6-4.4	— —	— —	5	7	55-75
DeB, DeD Deerton	0-8 8-24 24-38 38	2-10 3-12 — —	1.30-1.60 1.30-1.60 — —	6.0-20 2.0-20 0.2-0.6 0.2-2.0	0.06-0.10 0.05-0.10 — —	3.6-6.0 3.6-6.0 — —	Low Low — —	0.15 0.12 — —	4	1	.5-2
DIB*: Deerton	0-8 8-24 24-38 38	2-10 3-12 — —	1.30-1.60 1.30-1.60 — —	6.0-20 2.0-20 0.2-0.6 0.2-2.0	0.06-0.10 0.05-0.10 — —	3.6-6.0 3.6-6.0 — —	Low Low — —	0.15 0.12 — —	4	1	.5-2
Burt	0-5 5-17 17	2-10 0-8 —	1.30-1.60 1.30-1.60 —	6.0-20 6.0-20 0.2-2.0	0.12-0.14 0.04-0.08 —	4.5-6.5 4.5-6.5 —	Low Low —	0.17 0.15 —	2	2	10-20
Dn*, DnG* Duneland	0-60	0	1.50-1.60	>20	0.05-0.07	5.1-7.8	Low	0.15	5	1	—
EcB, EcD Adams	0-5 5-26 26-60	0-5 0-5 0-5	1.00-1.30 1.10-1.45 1.20-1.50	6.0-20 6.0-20 >20	0.06-0.12 0.03-0.10 0.03-0.04	5.0-6.0 5.0-6.0 4.5-6.5	Low Low Low	0.17 0.17 0.17	5	2	2-5
EkB*, EkD*, EkE*: Adams	0-5 5-26 26-60	0-5 0-5 0-5	1.00-1.30 1.10-1.45 1.20-1.50	6.0-20 6.0-20 >20	0.06-0.12 0.03-0.10 0.03-0.04	5.0-6.0 5.0-6.0 4.5-6.5	Low Low Low	0.17 0.17 0.17	5	2	2-5
Kalkaska	0-10 10-13 13-27 27-60	0-10 0-15 0-10 0-10	1.25-1.45 1.35-1.45 1.35-1.45 1.35-1.50	6.0-20 6.0-20 6.0-20 6.0-20	0.05-0.09 0.06-0.08 0.06-0.08 0.04-0.06	4.5-6.0 4.5-6.0 4.5-6.0 5.6-6.5	Low Low Low Low	0.15 0.15 0.15 0.15	5	1	1-4

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cc	In/hr	In/in	pH					Pct
Es*: Ensley	0-4 4-30 30-60	5-18 10-25 8-18	1.30-1.60 1.30-1.70 1.45-1.70	2.0-6.0 0.6-2.0 0.6-6.0	0.10-0.15 0.11-0.18 0.10-0.14	6.1-7.3 6.6-7.3 7.4-8.4	Low Low Low	0.24 0.24 0.20	5	3	3-6
Angelica	0-6 6-14 14-17 17-60	10-20 18-35 18-28 5-20	1.15-1.60 1.50-1.80 1.50-1.80 1.45-1.95	0.6-2.0 0.6-2.0 0.2-0.6 0.2-0.6	0.18-0.22 0.10-0.18 0.10-0.20 0.10-0.20	6.1-7.3 6.1-7.3 6.1-7.3 7.4-8.4	Low Low Moderate Low	0.32 0.32 0.32 0.32	5	5	2-12
Gw Greenwood	0-10 10-60	-- --	0.30-0.40 0.10-0.25	>6.0 0.6-6.0	0.55-0.65 0.45-0.55	3.6-4.4 3.6-4.4	-- --	-- --	5	7	55-75
HaB Halfaday	0-7 7-37 37-60	0-10 0-10 0-10	1.25-1.45 1.35-1.50 1.35-1.50	6.0-20 6.0-20 6.0-20	0.05-0.09 0.06-0.08 0.04-0.06	4.5-6.5 4.5-6.5 5.1-7.3	Low Low Low	0.15 0.15 0.15	5	1	.5-2
IoB Iosco	0-15 15-32 32-60	0-10 0-15 15-35	1.25-1.40 1.35-1.60 1.50-1.70	6.0-20 6.0-20 0.2-0.6	0.07-0.09 0.06-0.11 0.17-0.20	4.5-6.5 5.1-6.5 6.6-8.4	Low Low Moderate	0.15 0.17 0.37	5	1	1-4
Jb*: Jacobsville	0-5 5-9 9-23 23-36 36	-- 3-12 5-15 3-12 --	0.30-0.40 1.30-1.60 1.30-1.60 1.30-1.60 --	0.6-6.0 0.6-2.0 0.6-2.0 0.6-2.0 0.2-2.0	0.35-0.45 0.09-0.15 0.12-0.15 0.05-0.11 --	4.5-6.5 4.5-6.5 5.1-6.5 5.1-6.5 --	-- Low Low Low --	-- 0.24 0.28 0.20 --	4	2	40-60
Burt	0-5 5-17 17	2-10 0-8 --	1.30-1.60 1.30-1.60 --	2.0-6.0 6.0-20 0.2-2.0	0.14-0.17 0.04-0.08 --	4.5-6.5 4.5-6.5 --	Low Low --	0.24 0.15 --	2	3	10-20
KaB, KaD, KaE, KaG Kalkaska	0-10 10-13 13-27 27-60	0-10 0-15 0-10 0-10	1.25-1.45 1.35-1.45 1.35-1.45 1.35-1.50	6.0-20 6.0-20 6.0-20 6.0-20	0.05-0.09 0.06-0.08 0.06-0.08 0.04-0.06	4.5-6.0 4.5-6.0 4.5-6.0 5.6-6.5	Low Low Low Low	0.15 0.15 0.15 0.15	5	1	1-4
KdB, KdD, KdE- Karlin	0-4 4-17 17-22 22-60	12-15 2-15 0-15 0-10	1.35-1.60 1.35-1.60 1.40-1.65 1.40-1.70	2.0-6.0 2.0-6.0 6.0-20 6.0-20	0.15-0.17 0.08-0.16 0.03-0.08 0.03-0.04	4.5-6.0 4.5-6.0 4.5-6.0 5.6-6.5	Low Low Low Low	0.20 0.15 0.15 0.10	4	3	1-2
KgC Kawbawgam	0-6 6-24 24	5-15 5-15 --	1.30-1.60 1.30-1.70 --	0.6-2.0 0.6-6.0 0.2-2.0	0.08-0.14 0.08-0.14 --	4.5-5.5 5.1-6.0 --	Low Low --	0.24 0.24 --	4	3	2-4
KmB*, KmD*, KmE* Kalkaska	0-10 10-13 13-27 27-60	0-10 0-15 0-10 0-10	1.25-1.45 1.35-1.45 1.35-1.45 1.35-1.50	6.0-20 6.0-20 6.0-20 6.0-20	0.05-0.09 0.06-0.08 0.06-0.08 0.04-0.06	4.5-6.0 4.5-6.0 4.5-6.0 5.6-6.5	Low Low Low Low	0.15 0.15 0.15 0.15	5	1	1-4
Munising	0-6 6-16 16-46 46-60	5-12 5-12 5-18 5-15	1.30-1.65 1.35-1.65 1.80-2.10 1.55-1.75	2.0-6.0 0.6-2.0 <0.06 0.6-2.0	0.10-0.18 0.09-0.17 0.02-0.04 0.02-0.04	4.5-6.0 4.5-6.0 4.5-6.0 5.6-6.5	Low Low Low Low	0.20 0.20 0.20 0.24	4	3	1-3

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cc	In/hr	In/in	pH					Pct
KnB, KnD Keweenaw	0-8	2-15	1.35-1.60	2.0-6.0	0.09-0.12	4.5-6.5	Low	0.15	5	2	1-2
	8-29	2-15	1.45-1.80	2.0-6.0	0.08-0.11	4.5-6.5	Low	0.15			
	29-32	0-15	1.50-1.80	2.0-6.0	0.05-0.11	4.5-6.5	Low	0.15			
	32-39	0-15	1.50-1.80	0.6-6.0	0.06-0.14	4.5-6.5	Low	0.20			
	39-60	2-15	1.50-1.70	2.0-6.0	0.04-0.10	5.1-6.5	Low	0.15			
Kr Kinross	0-6	—	0.10-0.35	2.0-6.0	0.35-0.45	4.5-5.0	—	—	5	2	20-70
	6-42	0-10	1.40-1.70	6.0-20	0.04-0.09	4.5-5.0	Low	0.15			
	42-60	0-10	1.40-1.70	6.0-20	0.04-0.06	4.5-6.5	Low	0.15			
Lb* Lake beaches											
McB Mancelona	0-8	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
	8-22	2-15	1.30-1.65	6.0-20	0.06-0.12	5.6-7.3	Low	0.17			
	22-26	10-25	1.30-1.65	2.0-6.0	0.06-0.16	6.1-7.8	Low	0.17			
	26-60	0-10	1.45-1.65	>20	0.02-0.04	7.4-8.4	Low	0.10			
Mh* Marsh											
MuB, MuD Munising	0-6	5-12	1.30-1.65	2.0-6.0	0.10-0.18	4.5-6.0	Low	0.20	4	3	1-3
	6-16	5-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low	0.20			
	16-46	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low	0.20			
	46-60	5-15	1.55-1.75	0.6-2.0	0.02-0.04	5.6-6.5	Low	0.24			
MuE Munising	0-6	2-12	1.30-1.65	2.0-6.0	0.10-0.18	4.5-6.0	Low	0.20	4	3	1-3
	6-16	2-12	1.35-1.65	0.6-2.0	0.09-0.17	4.5-6.0	Low	0.20			
	16-46	5-18	1.80-2.10	<0.06	0.02-0.04	4.5-6.0	Low	0.20			
	46-60	5-15	1.55-1.75	0.6-2.0	0.02-0.04	5.6-6.5	Low	0.24			
Nh Nahma	0-4	—	0.30-0.40	0.2-6.0	0.35-0.45	6.1-7.8	—	—	4	2	40-60
	4-13	8-15	1.30-1.60	0.6-2.0	0.12-0.20	6.1-7.8	Low	0.24			
	13-33	12-18	1.40-1.70	0.6-2.0	0.10-0.19	6.6-8.4	Low	0.24			
	33	—	—	0.06-0.6	—	—	—	—			
OoE*: Onota											
Onota	0-7	5-15	1.30-1.65	2.0-6.0	0.12-0.15	5.1-6.5	Low	0.24	4	3	1-3
	7-24	8-18	1.30-1.65	0.6-6.0	0.11-0.14	5.1-6.5	Low	0.24			
	24-28	8-18	1.35-1.70	0.6-6.0	0.07-0.13	5.1-6.5	Low	0.24			
	28-31	—	—	0.2-0.6	—	—	—	—			
	31	—	—	0.2-2.0	—	—	—	—			
Chippeny	0-20	—	0.15-0.30	0.2-0.6	0.35-0.45	5.6-7.8	—	—	4	2	55-75
	20-28	5-45	1.45-1.75	0.06-2.0	0.04-0.19	6.6-8.4	Low	—			
	28	—	—	0.06-0.6	—	—	—	—			
OrB*, OrD*: Onota											
Onota	0-7	5-15	1.30-1.65	2.0-6.0	0.12-0.15	5.1-6.5	Low	0.24	4	3	1-3
	7-24	8-18	1.30-1.65	0.6-6.0	0.11-0.14	5.1-6.5	Low	0.24			
	24-28	8-18	1.35-1.70	0.6-6.0	0.07-0.13	5.1-6.5	Low	0.24			
	28-31	—	—	0.2-0.6	—	—	—	—			
	31	—	—	0.2-2.0	—	—	—	—			
Deerton	0-8	2-10	1.30-1.60	6.0-20	0.10-0.15	3.6-6.0	Low	0.17	4	2	.5-2
	8-24	3-12	1.30-1.60	2.0-20	0.05-0.10	3.6-6.0	Low	0.12			
	24-38	—	—	0.2-0.6	—	—	—	—			
	38	—	—	0.2-2.0	—	—	—	—			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	<u>In</u>	<u>Pct</u>	<u>G/cc</u>	<u>In/hr</u>	<u>In/in</u>	<u>pH</u>					<u>Pct</u>
OtB----- Otisco	0-9	2-12	1.25-1.40	6.0-20	0.10-0.12	5.1-6.5	Low-----	0.17	5	2	2-4
	9-29	2-12	1.25-1.40	2.0-20	0.06-0.11	5.1-6.5	Low-----	0.17			
	29-41	5-22	1.35-1.45	2.0-6.0	0.05-0.17	5.6-7.8	Low-----	0.17			
	41-60	0-12	1.25-1.50	2.0-20	0.05-0.10	6.6-7.8	Low-----	0.17			
Rc----- Roscommon	0-4	—	0.20-0.30	0.2-6.0	0.35-0.45	5.1-7.3	-----	—	5	2	40-60
	4-60	0-10	1.45-1.70	6.0-20	0.05-0.09	5.1-7.8	Low-----	0.17			
RkB*: Roscommon-----	0-4	—	0.20-0.30	0.2-6.0	0.35-0.45	5.1-7.3	-----	—	5	2	40-60
	4-60	0-10	1.45-1.70	6.0-20	0.05-0.09	5.1-7.8	Low-----	0.17			
Kalkaska-----	0-10	0-10	1.25-1.45	6.0-20	0.05-0.09	4.5-6.0	Low-----	0.15	5	1	1-4
	10-13	0-15	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low-----	0.15			
	13-27	0-10	1.35-1.45	6.0-20	0.06-0.08	4.5-6.0	Low-----	0.15			
	27-60	0-10	1.35-1.50	6.0-20	0.04-0.06	5.6-6.5	Low-----	0.15			
RuB, RuD, RuE----- Rubicon	0-4	0-5	1.25-1.45	6.0-20	0.05-0.09	4.5-6.0	Low-----	0.15	5	1	.5-2
	4-27	0-10	1.30-1.60	6.0-20	0.04-0.08	4.5-6.0	Low-----	0.15			
	27-60	0-5	1.40-1.65	6.0-20	0.04-0.06	5.6-6.5	Low-----	0.15			
ShB----- Sheldrake	0-60	0-5	1.30-1.60	>20	0.05-0.08	4.5-6.0	Low-----	0.15	5	1	.5-2
SkB----- Skanee	0-8	5-15	1.30-1.60	2.0-6.0	0.09-0.18	4.5-6.0	Low-----	0.24	3	3	2-3
	8-17	8-18	1.40-1.70	0.6-2.0	0.11-0.17	4.5-6.0	Low-----	0.24			
	17-36	15-25	1.75-2.10	<0.06	0.04-0.06	4.5-6.0	Low-----	0.24			
	36-60	8-18	1.40-1.70	0.6-2.0	0.02-0.04	4.5-6.0	Low-----	0.24			
StB, StD----- Steuben	0-8	2-12	1.10-1.60	2.0-6.0	0.10-0.12	4.5-6.0	Low-----	0.24	3	3	1-3
	8-21	10-18	1.25-1.80	0.6-2.0	0.13-0.18	4.5-6.0	Low-----	0.24			
	21-40	12-18	1.75-2.05	0.06-0.6	0.04-0.08	4.5-6.0	Low-----	0.17			
	40-60	0-5	1.45-1.65	6.0-20	0.02-0.06	5.1-6.5	Low-----	0.17			
SvA----- Sundell	0-8	2-15	1.30-1.50	2.0-6.0	0.12-0.16	6.1-7.8	Low-----	0.24	4	3	5-10
	8-23	2-15	1.30-1.50	0.6-6.0	0.08-0.15	6.1-7.8	Low-----	0.24			
	23-26	8-18	1.35-1.70	0.6-2.0	0.11-0.19	6.1-8.4	Low-----	0.24			
	26	—	—	0.06-0.6	—	—	-----	—			
SwA----- Sundell Variant	0-11	2-15	1.30-1.60	6.0-20	0.10-0.12	6.1-7.8	Low-----	0.17	4	2	1-3
	11-29	2-15	1.30-1.60	6.0-20	0.07-0.11	6.1-7.8	Low-----	0.17			
	29-35	2-15	1.30-1.60	6.0-20	0.07-0.11	6.1-7.8	Low-----	0.17			
	35	—	—	0.06-0.6	—	—	-----	—			
Ta----- Tawas	0-4	—	0.30-0.55	0.2-6.0	0.35-0.45	5.6-7.8	-----	—	4	5	40-60
	4-18	—	0.30-0.55	0.2-6.0	0.24-0.45	5.6-7.8	-----	—			
	18-60	0-10	1.40-1.65	6.0-20	0.03-0.10	5.1-7.8	Low-----	0.15			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	<u>In</u>	<u>Pct</u>	<u>G/cc</u>	<u>In/hr</u>	<u>In/in</u>	<u>pH</u>					<u>Pct</u>
TrB, TrD Trenary	0-6	2-15	1.35-1.55	2.0-6.0	0.14-0.18	5.1-6.0	Low	0.24	5	3	1-3
	6-17	2-15	1.35-1.60	2.0-6.0	0.14-0.19	5.1-6.0	Low	0.24			
	17-26	5-15	1.40-1.70	0.6-2.0	0.08-0.14	5.1-6.5	Low	0.24			
	26-37	18-30	1.40-1.80	0.6-2.0	0.14-0.20	5.1-7.8	Low	0.32			
	37-60	5-18	1.40-1.80	0.6-2.0	0.09-0.19	6.6-7.8	Low	0.24			
WaA Wainola	0-11	0-10	1.35-1.50	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	2-4
	11-26	2-12	1.35-1.45	6.0-20	0.06-0.11	4.5-6.5	Low	0.15			
	26-60	0-10	1.25-1.50	6.0-20	0.05-0.07	5.6-7.3	Low	0.15			
YaB, YaD Yalmer	0-9	0-5	1.35-1.55	6.0-20	0.07-0.09	4.5-6.0	Low	0.15	4	1	2-3
	9-26	0-10	1.30-1.60	6.0-20	0.06-0.11	4.5-6.0	Low	0.17			
	26-38	0-12	1.80-2.05	<0.06	0.02-0.04	4.5-6.0	Low	0.24			
	38-43	5-15	1.40-1.65	0.6-2.0	0.02-0.04	4.5-6.0	Low	0.24			
	43-60	5-15	1.40-1.65	0.6-2.0	0.02-0.04	5.1-6.0	Low	0.24			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--SOIL FEATURES

(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	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth In	Hardness	Initial In	Total In		Uncoated steel	Concrete
Ad* Alluvial land	>60	--	--	--	--	--	--
AsA Assinins	>60	--	--	--	High	Moderate	Moderate.
AuB Au Gres	>60	--	--	--	Moderate	Low	Moderate.
BIB, BID, BIE Blue Lake	>60	--	--	--	Low	Low	Moderate.
BoB, BoD Bohemian	>60	--	--	--	Moderate	Moderate	Moderate.
Bp* Borrow pits							
Bs Brevort	>60	--	--	--	Moderate	High	Moderate.
BtA Brimley	>60	--	--	--	High	High	Low.
Bu Bruce Variant	>60	--	--	--	High	High	Low.
BwC Burt	10-20	Hard	--	--	Moderate	High	High.
Cb* Carbondale	>60	--	6-18	43-54	High	High	Moderate.
Lupton	>60	--	6-18	50-55	High	High	Low.
Rifle	>60	--	--	--	High	High	Low.
Ck* Cathro	>60	--	4-12	19-22	High	High	Low.
Tacoosh	>60	--	4-20	9-29	High	High	Moderate.
CmD Chatham	>60	--	--	--	Moderate	Low	Low.
Cn Chippeny	20-51	Hard	4-10	15-18	High	High	Moderate.
CrA Croswell	>60	--	--	--	Low	Low	Moderate.
Dd* Dawson	>60	--	--	30-36	High	High	High.
Greenwood	>60	--	--	--	High	High	High.
DeB, DeD Deerton	20-40	Hard	--	--	Low	Low	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--SOIL FEATURES--Continued

Soil name and map symbol	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	<u>In</u>		<u>In</u>	<u>In</u>			
DIB*: Deerton	20-40	Hard	--	--	Low	Low	High.
Burt	10-20	Hard	--	--	Moderate	High	High.
Dn*, DnG* Duneland	>60	--	--	--	Low	Low	Moderate.
EcB, EcD Adams	>60	--	--	--	Low	Low	High.
EkB*, EkD*, EkE*: Adams	>60	--	--	--	Low	Low	High.
Kalkaska	>60	--	--	--	Low	Low	High.
Es*: Ensley	>60	--	--	--	High	High	Low.
Angelica	>60	--	--	--	High	High	Low.
Gw Greenwood	>60	--	--	--	High	High	High.
HaB Halfaday	>60	--	--	--	Low	Low	High.
IoB Iosco	>60	--	--	--	Moderate	High	Low.
Jb*: Jacobsville	20-40	Hard	--	--	High	High	High.
Burt	10-20	Hard	--	--	Moderate	High	High.
KaB, KaD, KaE Kalkaska	>60	--	--	--	Low	Low	High.
KaG Kalkaksa	>60	--	--	--	Low	Low	High.
KdB, KdD, KdE Karlín	>60	--	--	--	Low	Low	High.
KgC Kawbawgam	20-40	Hard	--	--	High	Moderate	High.
KmB*, KmD*, KmE*: Kalkaska	>60	--	--	--	Low	Low	High.
Munising	>60	--	--	--	Moderate	Low	High.
KnB, KnD Keweenaw	>60	--	--	--	Low	Low	Moderate.
Kr Kinross	>60	--	--	--	Moderate	High	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--SOIL FEATURES--Continued

Soil name and map symbol	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	<u>In</u>		<u>In</u>	<u>In</u>			
Lb* Lake beaches							
McB----- Mancelona	>60	--	--	--	Low-----	Low-----	Low.
Mh* Marsh							
MuB, MuD, MuE----- Munising	>60	--	--	--	Moderate-----	Low-----	High.
Nh----- Nahma	20-40	Hard	--	--	High-----	High-----	Low.
OoE*: Onota-----	20-40	Hard	--	--	Moderate-----	Low-----	Moderate.
Chippeny-----	20-51	Hard	4-10	15-18	High-----	High-----	Moderate.
OrB*, OrD*: Onota-----	20-40	Hard	--	--	Moderate-----	Low-----	Moderate.
Deerton-----	20-40	Hard	--	--	Low-----	Low-----	High.
OtB----- Otisco	>60	--	--	--	Moderate-----	Low-----	Moderate.
Rc----- Roscommon	>60	--	--	--	Moderate-----	High-----	Low.
RkB*: Roscommon-----	>60	--	--	--	Moderate-----	High-----	Low.
Kalkaska-----	>60	--	--	--	Low-----	Low-----	High.
RuB, RuD, RuE----- Rubicon	>60	--	--	--	Low-----	Low-----	High.
ShB----- Shelldrake	>60	--	--	--	Low-----	Low-----	High.
SkB----- Skanee	>60	--	--	--	High-----	Moderate-----	High.
StB, StD----- Steuben	>60	--	--	--	Moderate-----	Low-----	High.
SvA----- Sundell	20-40	Hard	--	--	High-----	Moderate-----	Low.
SwA----- Sundell Variant	20-40	Hard	--	--	Moderate-----	Low-----	Moderate.
Ta----- Tawas	>60	--	4-15	25-30	High-----	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--SOIL FEATURES--Continued

Soil name and map symbol	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	<u>In</u>		<u>In</u>	<u>In</u>			
TrB, TrD Trenary	>60	--	--	--	Moderate	Low	Moderate.
WaA Wainola	>60	--	--	--	Moderate	Low	Moderate.
YaB, YaD Yalmer	>60	--	--	--	Low	Low	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth Ft	Kind	Months
Ad* Alluvial land	--	Frequent	Long	Jan-Dec	+1-1.0	Apparent	Oct-Jun
AsA Assinins	B	None	--	--	0.5-1.5	Apparent	Nov-May
AuB Au Gres	B	None	--	--	0.5-1.5	Apparent	Nov-May
BIB, BID, BIE Blue Lake	A	None	--	--	>6.0	--	--
BoB, BoD Bohemian	B	None	--	--	>6.0	--	--
Bp* Borrow pits							
Bs Brevort	B/D	None	--	--	+1-1.0	Apparent	Nov-May
BlA Brimley	C	None	--	--	1.0-2.0	Apparent	Nov-May
Bu Bruce Variant	B/D	None	--	--	+1-1.0	Apparent	Nov-May
BwC Burt	D	None	--	--	+5-1.0	Apparent	Oct-Jun
Cb* Carbondale	A/D	None	--	--	+1-1.0	Apparent	Sep-May
Lupton	A/D	None	--	--	+1-1.0	Apparent	Sep-May
Rifle	A/D	None	--	--	+1-1.0	Apparent	Nov-Jun
Ck* Cathro	A/D	None	--	--	+1-1.0	Apparent	Nov-Jun
Tacoosh	B/D	None	--	--	+1-1.0	Apparent	Sep-May
CmD Chatham	B	None	--	--	>6.0	--	--
Cn Chippeny	D	None	--	--	+1-1.0	Apparent	Sep-May
CrA Crosswell	A	None	--	--	2.0-5.0	Apparent	Nov-May
Dd* Dawson	A/D	None	--	--	+1-1.0	Apparent	Sep-Jun
Greenwood	A/D	None	--	--	+1-1.0	Apparent	Sep-Jun

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth Ft	Kind	Months
DeB, DeD Deerton	A	None	--	--	>6.0	--	--
DIB*: Deerton	A	None	--	--	>6.0	--	--
Burt	D	None	--	--	+5-1.0	Apparent	Oct-Jun
Dn*, DnG* Duneland	A	None	--	--	>6.0	--	--
EcB, EcD Adams	A	None	--	--	>6.0	--	--
EkB*, EkD*, EkE*: Adams	A	None	--	--	>6.0	--	--
Kalkaska	A	None	--	--	>6.0	--	--
Es*: Ensley	B/D	None	--	--	+1-1.0	Apparent	Nov-Jun
Angelica	B/D	None	--	--	+1-1.0	Apparent	Oct-Jun
Gw Greenwood	A/D	None	--	--	+1-1.0	Apparent	Sep-Jun
HaB Halfaday	A	None	--	--	2.0-5.0	Apparent	Nov-Apr
IoB Iosco	B	None	--	--	0.5-1.5	Apparent	Nov-Jun
Jb*: Jacobsville	D	None	--	--	+5-1.0	Apparent	Nov-May
Burt	D	None	--	--	+5-1.0	Apparent	Oct-Jun
KaB, KaD, KaE Kalkaska	A	None	--	--	>6.0	--	--
KaG Kalkaska	A	None	--	--	>6.0	--	--
KdB, KdD, KdE Karlin	A	None	--	--	>6.0	--	--
KgC Kawbawgam	C	None	--	--	0.5-1.0	Apparent	Nov-May
KmB*: Kalkaska	A	None	--	--	>6.0	--	--
Munising	B	None	--	--	1.0-2.0	Perched	Nov-May
KmD*, KmE*: Kalkaska	A	None	--	--	>6.0	--	--
Munising	B	None	--	--	>6.0	--	--

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth Fl	Kind	Months
KnB, KnD Keweenaw	A	None	--	--	>6.0	--	--
Kr Kinross	A/D	None	--	--	+1-1.0	Apparent	Sep-Jun
Lb* Lake beaches							
McB Mancelona	A	None	--	--	>6.0	--	--
Mh* Marsh							
MuB, MuD Munising	B	None	--	--	1.0-2.0	Perched	Nov-May
MuE Munising	B	None	--	--	>6.0	--	--
Nh Nahma	B/D	None	--	--	+1-1.0	Apparent	Nov-Jun
OoE*: Onota	B	None	--	--	>6.0	--	--
Chippeny	D	None	--	--	+1-1.0	Apparent	Sep-May
OrB*, OrD*: Onota	B	None	--	--	>6.0	--	--
Deerton	A	None	--	--	>6.0	--	--
OtB Otisco	A	None	--	--	0.5-1.5	Apparent	Nov-May
Rc Roscommon	A/D	None	--	--	+1-1.0	Apparent	Sep-Jun
RkB*: Roscommon	A/D	None	--	--	+1-1.0	Apparent	Sep-Jun
Kalkaska	A	None	--	--	>6.0	--	--
RuB, RuD, RuE Rubicon	A	None	--	--	>6.0	--	--
ShB Shelldrake	A	None	--	--	>6.0	--	--
SkB Skanee	C	None	--	--	0.5-1.5	Perched	Nov-May
StB, StD Steuben	B	None	--	--	1.0-2.5	Perched	Nov-May
SvA Sundell	B	None	--	--	0.5-1.5	Apparent	Nov-May

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth Ft	Kind	Months
SwA Sundell Variant	A	None	—	—	1.0-2.0	Apparent	Nov-May
Ta Tawas	A/D	None	—	—	+1-1.0	Apparent	Nov-May
TrB, TrD Trenary	B	None	—	—	>6.0	—	—
WaA Wainola	B	None	—	—	0.5-1.5	Apparent	Nov-May
YaB, YaD Yalmer	B	None	—	—	1.5-2.0	Perched	Mar-May

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--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
Ad* Alluvial land	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.
AsA Assinins	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
AuB Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
BIB Blue Lake	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
BID Blue Lake	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
BIE Blue Lake	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
BoB Bohemian	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey, too sandy.	Slight	Poor: too clayey.
BoD Bohemian	Severe: percs slowly.	Severe: slope.	Severe: too clayey, too sandy.	Moderate: slope.	Poor: too clayey.
Bp* Borrow pits					
Bs Brevort	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding, excess humus.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
BtA Brimley	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: wetness.
Bu Bruce Variant	Severe: ponding.	Severe: excess humus, ponding.	Severe: ponding, too sandy.	Severe: ponding.	Poor: ponding.
BwC Burt	Severe: depth to rock, ponding.	Severe: seepage, depth to rock, ponding.	Severe: depth to rock, seepage, ponding.	Severe: depth to rock, ponding.	Poor: depth to rock, seepage, too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Cb*: Carbondale-----	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Lupton-----	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Rifle-----	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Ck*: Cathro-----	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
Tacoosh-----	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
CmD----- Chatham	Moderate: slope, large stones.	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: seepage.	Poor: seepage, large stones.
Cn----- Chippeny	Severe: depth to rock, ponding, percs slowly.	Severe: depth to rock, excess humus, ponding.	Severe: depth to rock, ponding, excess humus.	Severe: depth to rock, ponding.	Poor: depth to rock, ponding, excess humus.
CrA----- Croswell	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Dd*: Dawson-----	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Greenwood-----	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
DeB----- Deerton	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock, seepage, too sandy.
DeD----- Deerton	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock, seepage, too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
DIB*: Deerton-----	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock, seepage, too sandy.
Burt-----	Severe: depth to rock, ponding.	Severe: seepage, depth to rock, ponding.	Severe: depth to rock, seepage, ponding.	Severe: depth to rock, ponding.	Poor: depth to rock, seepage, too sandy.
Dn*, DnG*----- Duneland	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
EcB----- Adams	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
EcD----- Adams	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
EkB*: Adams-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Kalkaska-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
EkD*: Adams-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Kalkaska-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
EkE*: Adams-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Kalkaska-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Es*: Ensley-----	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
Angelica-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Gw----- Greenwood	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
HaB----- Halfaday	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
IoB----- Iosco	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Jb*: Jacobsville-----	Severe: depth to rock, ponding.	Severe: depth to rock, excess humus, ponding.	Severe: depth to rock, ponding.	Severe: depth to rock, ponding.	Poor: depth to rock, ponding.
Burt-----	Severe: depth to rock, ponding.	Severe: seepage, depth to rock, ponding.	Severe: depth to rock, seepage, ponding.	Severe: depth to rock, ponding.	Poor: depth to rock, seepage, too sandy.
KaB----- Kalkaska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
KaD----- Kalkaska	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
KaE----- Kalkaska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
KaG----- Kalkaksa	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
KdB----- Karlin	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
KdD----- Karlin	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
KdE----- Karlin	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
KgC----- Kawbawgam	Severe: depth to rock, wetness.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage, wetness.	Severe: depth to rock, seepage, wetness.	Poor: depth to rock, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
KmB*: Kalkaska-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Munising-----	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.
KmD*, KmE*: Kalkaska-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Munusing-----	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: seepage, slope.
KnB----- Keweenaw	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
KnD----- Keweenaw	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
Kr----- Kinross	Severe: ponding, poor filter.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Lb*. Lake beaches					
McB----- Mancelona	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Mh*. Marsh					
MuB----- Munising	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.
MuD----- Munising	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: seepage, wetness.
MuE----- Munising	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: seepage, slope.
Nh----- Nahma	Severe: depth to rock, ponding.	Severe: depth to rock, excess humus, ponding.	Severe: depth to rock, ponding.	Severe: depth to rock, ponding.	Poor: depth to rock, ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
OoE*: Onota-----	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, slope.
Chippeny-----	Severe: depth to rock, ponding, percs slowly.	Severe: depth to rock, excess humus, ponding.	Severe: depth to rock, ponding, excess humus.	Severe: depth to rock, ponding.	Poor: depth to rock, ponding, excess humus.
OrB*: Onota-----	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock.
Deerton-----	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock, seepage, too sandy.
OrD*: Onota-----	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock.
Deerton-----	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock, seepage, too sandy.
OtB----- Otisco	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Rc----- Roscommon	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
RkB*: Roscommon-----	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Kalkaska-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
RuB----- Rubicon	Severe: poor filter.	Severe: seepage, large stones.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RuD----- Rubicon	Severe: poor filter.	Severe: seepage, slope, large stones.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
RuE----- Rubicon	Severe: poor filter, slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
ShB----- Shelldrake	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
SkB----- Skanee	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
StB----- Steuben	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
StD----- Steuben	Severe: wetness, percs slowly, poor filter.	Severe: seepage, slope, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
SvA----- Sundell	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Poor: depth to rock, wetness.
SwA----- Sundell Variant	Severe: depth to rock, wetness, poor filter.	Severe: seepage, depth to rock, wetness.	Severe: depth to rock, seepage, wetness.	Severe: depth to rock, seepage, wetness.	Poor: depth to rock, wetness.
Ta----- Tawas	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
TrB----- Trenary	Moderate: percs slowly.	Severe: seepage.	Slight-----	Slight-----	Good.
TrD----- Trenary	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope.
WaA----- Wainola	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness.
YaB----- Yalmer	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage.	Fair: small stones, wetness.
YaD----- Yalmer	Severe: wetness, percs slowly.	Severe: seepage, slope, wetness.	Severe: wetness.	Severe: seepage.	Fair: small stones, slope, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--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
Ad* Alluvial land	Severe: ponding.	Severe: flooding; ponding.	Severe: flooding; ponding.	Severe: flooding; ponding.	Severe: ponding; flooding.	Severe: ponding; flooding.
AsA Assinins	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness; frost action.	Severe: wetness.
AuB Au Gres	Severe: cutbanks cave; wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
BIB Blue Lake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty; too sandy.
BID Blue Lake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty; slope; too sandy.
BIE Blue Lake	Severe: cutbanks cave; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
BoB Bohemian	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength; frost action.	Slight.
BoD Bohemian	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength; slope; frost action.	Moderate: slope.
Bp* Borrow pits						
Bs Brevort	Severe: cutbanks cave; ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding; excess humus.	Severe: ponding.
BlA Brimley	Severe: cutbanks cave; wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
Bu Bruce Variant	Severe: cutbanks cave; ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding; frost action.	Severe: ponding.
BwC Burt	Severe: depth to rock; ponding.	Severe: ponding; depth to rock.	Severe: ponding; depth to rock.	Severe: ponding; depth to rock.	Severe: depth to rock; ponding.	Severe: ponding; depth to rock.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--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
Cb*: Carbondale	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.
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.
Rifle	Severe: excess humus; ponding.	Severe: ponding; low strength.	Severe: ponding; low strength.	Severe: ponding; low strength.	Severe: ponding; frost action.	Severe: ponding; excess humus.
Ck*: Cathro	Severe: excess humus; ponding.	Severe: subsides; ponding.	Severe: subsides; ponding.	Severe: subsides; ponding.	Severe: subsides; ponding; frost action.	Severe: ponding; excess humus.
Tacoosh	Severe: excess humus; ponding.	Severe: ponding; low strength.	Severe: ponding.	Severe: ponding; low strength.	Severe: ponding; frost action.	Severe: ponding; excess humus.
CmD Chatham	Severe: cutbanks cave.	Moderate: slope; large stones.	Moderate: slope; large stones.	Severe: slope.	Moderate: slope; frost action; large stones.	Moderate: large stones; droughty; slope.
Cn Chippeny	Severe: depth to rock; cutbanks cave; ponding.	Severe: subsides; ponding; low strength.	Severe: subsides; ponding; depth to rock.	Severe: subsides; ponding; low strength.	Severe: subsides; ponding; frost action.	Severe: ponding; excess humus.
CrA Croswell	Severe: cutbanks cave; wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty; too sandy.
Dd*: Dawson	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.
Greenwood	Severe: excess humus; ponding.	Severe: ponding; low strength.	Severe: ponding; low strength.	Severe: ponding; low strength.	Severe: ponding; excess humus.	Severe: ponding; excess humus.
DeB Deerton	Severe: depth to rock; cutbanks cave.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: droughty; depth to rock.
DeD Deerton	Severe: depth to rock; cutbanks cave.	Moderate: slope; depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock; slope.	Moderate: droughty; slope; depth to rock.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.—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
DIB*: Deerton	Severe: depth to rock; cutbanks cave.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: droughty; depth to rock.
Burt	Severe: depth to rock; ponding.	Severe: ponding; depth to rock.	Severe: ponding; depth to rock.	Severe: ponding; depth to rock.	Severe: depth to rock; ponding.	Severe: ponding; depth to rock.
Dn*; DnG* Duneland	Severe: cutbanks cave; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
EcB Adams	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
EcD Adams	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
EkB*: Adams	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
Kalkaska	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty; too sandy.
EkD*: Adams	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Kalkaska	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty; slope; too sandy.
EkE*: Adams	Severe: cutbanks cave; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty; slope.
Kalkaska	Severe: cutbanks cave; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Es*: Ensley	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding; frost action.	Severe: ponding.
Angelica	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding; frost action.	Severe: ponding.
Gw Greenwood	Severe: excess humus; ponding.	Severe: ponding; low strength.	Severe: ponding; low strength.	Severe: ponding; low strength.	Severe: ponding; excess humus.	Severe: ponding; excess humus.
HaB Halfaday	Severe: cutbanks cave; wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty; too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--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
IoB Iosco	Severe: cutbanks cave; wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Jb*: Jacobsville	Severe: depth to rock; cutbanks cave; ponding.	Severe: ponding.	Severe: ponding; depth to rock.	Severe: ponding.	Severe: ponding; frost action.	Severe: ponding; excess humus.
Burt	Severe: depth to rock; ponding.	Severe: ponding; depth to rock.	Severe: ponding; depth to rock.	Severe: ponding; depth to rock.	Severe: depth to rock; ponding.	Severe: ponding; depth to rock.
KaB Kalkaska	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty; too sandy.
KaD Kalkaska	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty; slope; too sandy.
KaE Kalkaska	Severe: cutbanks cave; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
KaG Kalkaska	Severe: cutbanks cave; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
KdB Karin	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
KdD Karin	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty; slope.
KdE Karin	Severe: cutbanks cave; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
KgC Kawbawgan	Severe: depth to rock; wetness.	Severe: wetness.	Severe: wetness; depth to rock.	Severe: wetness.	Severe: wetness; frost action.	Severe: wetness.
KmB*: Kalkaska	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty; too sandy.
Munising	Severe: cutbanks cave; wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness; frost action.	Moderate: wetness; droughty.
KmD*; Kalkaska	Severe: cutbanks cave; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--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
KmD* ¹ ; KmE* ² : Munising	Severe: cutbanks cave; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
KnB Keweenaw	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: large stones; droughty.
KnD Keweenaw	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones; droughty; slope.
Kr Kinross	Severe: cutbanks cave; ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Lb* Lake beaches						
McB Mancelona	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: large stones; droughty.
Mh* Marsh						
MuB Munising	Severe: cutbanks cave; wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness; frost action.	Moderate: wetness; droughty.
MuD Munising	Severe: cutbanks cave; wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness; slope.	Moderate: wetness; slope; frost action.	Moderate: wetness; droughty; slope.
MuE Munising	Severe: cutbanks cave; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Nh Nahma	Severe: depth to rock; ponding.	Severe: ponding.	Severe: ponding; depth to rock.	Severe: ponding.	Severe: ponding; frost action.	Severe: ponding; excess humus.
OoE* Onota	Severe: depth to rock; cutbanks cave; slope.	Severe: slope.	Severe: depth to rock; slope.	Severe: slope.	Severe: slope.	Severe: slope.
Chippeny	Severe: depth to rock; cutbanks cave; ponding.	Severe: subsides; ponding; low strength.	Severe: subsides; ponding; depth to rock.	Severe: subsides; ponding; low strength.	Severe: subsides; ponding; frost action.	Severe: ponding; excess humus.
OrB* Onota	Severe: depth to rock; cutbanks cave.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock; frost action.	Moderate: large stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--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
OrB*: Deerton	Severe: depth to rock; cutbanks cave.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: droughty; depth to rock.
OrD*: Onota	Severe: depth to rock; cutbanks cave.	Moderate: slope; depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock; slope; frost action.	Moderate: large stones; slope.
Deerton	Severe: depth to rock; cutbanks cave.	Moderate: slope; depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock; slope.	Moderate: droughty; slope; depth to rock.
OtB Otisco	Severe: cutbanks cave; wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Rc Roscommon	Severe: cutbanks cave; ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
RkB*: Roscommon	Severe: cutbanks cave; ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Kalkaska	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty; too sandy.
RuB Rubicon	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
RuD Rubicon	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
RuE Rubicon	Severe: cutbanks cave; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty; slope.
ShB Sheldrake	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty; too sandy.
SkB Skane	Severe: cutbanks cave; wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness; frost action.	Severe: wetness.
SIB Steuben	Severe: cutbanks cave; wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness; frost action.	Moderate: wetness; droughty.
SID Steuben	Severe: cutbanks cave; wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness; slope.	Moderate: wetness; slope; frost action.	Moderate: wetness; droughty; slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--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
SvA _____ Sundell	Severe: depth to rock; wetness.	Severe: wetness.	Severe: wetness; depth to rock.	Severe: wetness.	Severe: wetness; frost action.	Severe: wetness.
SwA _____ Sundell Variant	Severe: depth to rock; cutbanks cave; wetness.	Severe: wetness.	Severe: wetness; depth to rock.	Severe: wetness.	Moderate: depth to rock; wetness; frost action.	Moderate: wetness; droughty; depth to rock.
Ta _____ 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.
TrB _____ Trenary	Severe: cutbanks cave.	Slight _____	Slight _____	Moderate: slope.	Moderate: frost action.	Moderate: large stones.
TrD _____ Trenary	Severe: cutbanks cave; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
WaA _____ Wainola	Severe: cutbanks cave; wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
YaB _____ Yalmer	Severe: cutbanks cave; wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: droughty.
YaD _____ Yalmer	Severe: cutbanks cave; wetness.	Moderate: wetness; slope.	Severe: wetness.	Severe: slope.	Moderate: wetness; slope.	Severe: droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--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
Ad* Alluvial land	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
AsA Assinins	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy wetness.
AuB Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy wetness.
BIB, BID Blue Lake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
BIE Blue Lake	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy slope.
BoB Bohemian	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
BoD Bohemian	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer slope.
Bp* Borrow pits				
Bs Brevort	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy small stones wetness.
BtA Brimley	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Bu Bruce Variant	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy wetness.
BwC Burt	Poor: depth to rock wetness.	Improbable: thin layer.	Improbable: too sandy	Poor: depth to rock too sandy. wetness.
Cb* Carbondale	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus wetness.
Lupton	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Cb*: Rifle	Poor: wetness low strength.	Improbable: excess humus	Improbable: excess humus.	Poor: excess humus. wetness.
Ck*: Cathro	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus wetness.
Tacoosh	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus wetness.
CmD Chatham	Fair: large stones.	Improbable: large stones.	Improbable: too sandy large stones.	Poor: large stones area reclaim.
Cn Chippeny	Poor: depth to rock wetness.	Improbable: excess humus	Improbable: excess humus.	Poor: excess humus. small stones wetness.
CrA Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Dd*: Dawson	Poor: wetness.	Probable	Probable	Poor: excess humus wetness.
Greenwood	Poor: wetness low strength.	Improbable: excess humus	Improbable: excess humus.	Poor: excess humus. wetness.
DeB, DeD Deerton	Poor: depth to rock.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
DIB*: Deerton	Poor: depth to rock.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
Burt	Poor: depth to rock wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: depth to rock too sandy wetness.
Dn* Duneland	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy slope.
DnG* Duneland	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy slope.
EcB, EcD Adams	Good	Probable	Improbable: too sandy.	Poor: too sandy.
EkB*, EkD* Adams	Good	Probable	Improbable: too sandy.	Poor: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
EkB*, EkD* Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
EKE*: Adams	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy slope.
Kalkaska	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy slope.
Es*: Ensley	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones wetness.
Angelica	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim small stones wetness.
Gw Greenwood	Poor: wetness low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus wetness.
HaB Halfaday	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
IoB Iosco	Poor: wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy wetness.
Jb*: Jacobsville	Poor: depth to rock wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones wetness.
Burt	Poor: depth to rock wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: depth to rock too sandy wetness.
KaB, KaD Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
KaE Kalkaska	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy slope.
KaG Kalkaksa	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy slope.
KdB Karlin	Good	Probable	Improbable: too sandy.	Fair: too sandy small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
KdD Karlín	Good	Probable	Improbable: too sandy.	Fair: too sandy small stones slope.
KdE Karlín	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope.
KgC Kawbawgam	Poor: depth to rock wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones wetness.
KmB*: Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Munising	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Fair: area reclaim too sandy small stones.
KmD*: Kalkaska	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy slope.
Munusing	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: slope.
KmE*: Kalkaska	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy slope.
Munusing	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: slope.
KnB, KnD Keweenaw	Good	Probable	Improbable: too sandy.	Poor: too sandy small stones area reclaim.
Kr Kinross	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy wetness.
Lb*. Lake beaches				
McB Mancelona	Good	Probable	Probable	Poor: too sandy small stones area reclaim.
Mh*. Marsh				
MuB, MuD Munising	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Fair: area reclaim too sandy small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MuE----- Munising	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: slope.
Nh----- Nahma	Poor: depth to rock wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones wetness.
OoE*: Onota-----	Poor: depth to rock slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Chippeny-----	Poor: depth to rock wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus small stones wetness.
OrB*: Onota-----	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock large stones.
Deerton-----	Poor: depth to rock.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
OrD*: Onota-----	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock large stones slope.
Deerton-----	Poor: depth to rock.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
OtB----- Otisco	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: too sandy wetness.
Rc----- Roscommon	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: too sandy wetness.
RkB*: Roscommon-----	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: too sandy wetness.
Kalkaska-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
RuB, RuD----- Rubicon	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy small stones area reclaim.
RuE----- Rubicon	Poor: slope.	Probable-----	Improbable: too sandy.	Poor: too sandy slope.
ShB----- Shelldrake	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SkB----- Skaneec	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim wetness.
StB, StD----- Steuben	Fair: wetness.	Probable-----	Improbable: too sandy.	Poor: area reclaim.
SvA----- Sundell	Poor: depth to rock wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
SwA----- Sundell Variant	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock too sandy thin layer.
Ta----- Tawas	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: excess humus wetness.
TrB----- Trenary	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
TrD----- Trenary	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
WaA----- Wainola	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy wetness.
YaB, YaD----- Yalmer	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
Ad* Alluvial land	Slight	Severe: ponding.	Slight	Ponding, flooding.	Ponding, flooding.	Wetness.
AsA Assinins	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action--	Wetness, droughty.	Wetness, erodes easily, droughty.
AuB Au Gres	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, droughty.
BIB Blue Lake	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
BID, BIE Blue Lake	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
BoB Bohemian	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Erodes easily.
BoD Bohemian	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope, erodes easily.
Bp* Borrow pits						
Bs Brevort	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding	Ponding, droughty, fast intake.	Wetness, erodes easily, droughty.
BlA Brimley	Slight	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness, erodes easily.
Bu Bruce Variant	Moderate: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Wetness, erodes easily.
BwC Burt	Severe: depth to rock.	Severe: thin layer, seepage, piping.	Severe: depth to rock, cutbanks cave.	Ponding, depth to rock, cutbanks cave.	Ponding, droughty.	Wetness, droughty, depth to rock.
Cb* Carbondale	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding	Wetness.
Lupton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
Cb*: Rifle	Severe: seepage.	Severe: excess humus, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding	Wetness.
Ck*: Cathro	Severe: seepage.	Severe: seepage, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
Tacoosh	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
CmD Chatham	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Large stones, slope, droughty.
Cn Chippeny	Moderate: seepage, depth to rock.	Severe: excess humus, ponding.	Severe: slow refill, depth to rock, cutbanks cave.	Ponding, percs slowly, depth to rock.	Ponding, soil blowing, percs slowly.	Wetness, depth to rock, rooting depth.
CrA Croswell	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Droughty.
Dd*: Dawson	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, rooting depth.	Wetness, rooting depth.
Greenwood	Severe: seepage.	Severe: excess humus, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding	Wetness.
DeB Deerton	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty, depth to rock.
DeD Deerton	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty, depth to rock.
DIB*: Deerton	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty, depth to rock.
Burt	Severe: depth to rock.	Severe: thin layer, seepage, piping.	Severe: depth to rock, cutbanks cave.	Ponding, depth to rock, cutbanks cave.	Ponding, fast intake, soil blowing.	Wetness, droughty, depth to rock.
Dn*, DnG* Duneland	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
EcB Adams	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
EcD----- Adams	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
EkB*: Adams-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Kalkaska-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
EkD*, EkE*: Adams-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Kalkaska-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Es*: Ersley-----	Severe: seepage.	Severe: seepage, piping, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding, soil blowing.	Wetness.
Angelica-----	Slight-----	Severe: piping, ponding	Severe: slow refill.	Ponding, frost action.	Ponding, rooting depth.	Wetness, rooting depth.
Gw----- Greenwood	Severe: seepage.	Severe: excess humus, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding-----	Wetness.
HaB----- Halfaday	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Droughty.
IoB----- Iosco	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: slow refill, cutbanks cave.	Slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, erodes easily, droughty.
Jb*: Jacobsville-----	Moderate: seepage, depth to rock.	Severe: piping, ponding.	Severe: depth to rock, cutbanks cave.	Ponding, depth to rock, frost action.	Ponding, soil blowing.	Large stones, wetness.
Burt-----	Severe: depth to rock.	Severe: thin layer, seepage, piping.	Severe: depth to rock, cutbanks cave.	Ponding, depth to rock, cutbanks cave.	Ponding, droughty.	Wetness, droughty, depth to rock.
KaB----- Kalkaska	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
KaD, KaE----- Kalkaska	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
KaG----- Kalkaksa	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
KdB----- Karlin	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Droughty.
KdD, KdE----- Karlin	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, droughty.
KgC----- Kawbawgam	Severe: seepage.	Severe: piping, wetness.	Severe: depth to rock.	Depth to rock, frost action, slope.	Slope, wetness, droughty.	Wetness, droughty.
KmB*: Kalkaska-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Munising-----	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, droughty.
KmD*, KmE*: Kalkaska-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Munusing-----	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, droughty, rooting depth.
KnB----- Keweenaw	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Large stones, droughty.
KaD, KaE----- Kalkaksa	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
KaG----- Kalkaksa	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
KdB----- Karlin	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Droughty.
KdD, KdE----- Karlin	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, droughty.
KgC----- Kawbawgam	Severe: seepage.	Severe: piping, wetness.	Severe: depth to rock.	Depth to rock, frost action, slope.	Slope, wetness, droughty.	Wetness, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
KmB*: Kalkaska-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Munising-----	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, droughty.
KmD*, KmE*: Kalkaska-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Munising-----	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, droughty, rooting depth.
KnB----- Keweenaw	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Large stones, droughty.
KnD----- Keweenaw	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Large stones, slope, droughty.
Kr----- Kinross	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding.	Wetness.
Lb*. Lake beaches						
McB----- Mancelona	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Mh*. Marsh						
MuB----- Munising	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, droughty.
MuD----- Munising	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, slope, droughty.
MuE----- Munising	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, droughty, rooting depth.
Nh----- Nahma	Moderate: seepage, depth to rock.	Severe: piping, ponding.	Severe: depth to rock.	Ponding, depth to rock, frost action.	Ponding, soil blowing, depth to rock.	Large stones, wetness, depth to rock.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
OoE*: Onota-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, depth to rock.
Chippeny-----	Moderate: seepage, depth to rock.	Severe: excess humus, ponding.	Severe: slow refill, depth to rock, cutbanks cave.	Ponding, percs slowly, depth to rock.	Ponding, soil blowing, percs slowly.	Wetness, depth to rock, rooting depth.
OrB*: Onota-----	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Depth to rock.
Deerton-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty, depth to rock.
OrD*: Onota-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, depth to rock.
Deerton-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty, depth to rock.
OtB----- Otisco	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, droughty.
Rc----- Roscommon	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
RkB*: Roscommon-----	Severe: seepage.	Severe: seepage, piping, ponding	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
RkB*: Kalkaska-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
RuB----- Rubicon	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
RuD, RuE----- Rubicon	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
ShB----- Shelldrake	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
SkB----- Skaneec	Moderate: seepage, slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, droughty.	Wetness, droughty, rooting depth.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
StB Steuben	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, droughty.
StD Steuben	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, slope, droughty.
SvA Sundell	Moderate: seepage, depth to rock.	Severe: piping, wetness.	Severe: depth to rock.	Depth to rock, frost action.	Wetness, soil blowing.	Wetness, depth to rock.
SwA Sundell Variant	Severe: seepage.	Severe: piping, wetness.	Severe: depth to rock, cutbanks cave.	Depth to rock, cutbanks cave.	Wetness, droughty.	Wetness, droughty, depth to rock.
Ta Tawas	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
TrB Trenary	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, rooting depth.	Rooting depth.
TrD Trenary	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, rooting depth.	Slope, rooting depth.
WaA Wainola	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
YaB Yalmer	Severe: seepage.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, wetness, droughty.	Droughty, rooting depth.
YaD Yalmer	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, wetness, droughty.	Slope, droughty, rooting depth.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.—WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of—			
	8-15	16-25	26-35	>35
Ad*. Alluvial land				
AsA— Assinins	Lilac, silky dogwood, nannyberry viburnum, American cranberrybush, sargent crabapple.	White spruce, northern whitecedar, Siberian crabapple.	Eastern white pine, Norway spruce, green ash, red maple.	—
AuB— Au Gres	American cranberrybush, Amur maple, common ninebark, nannyberry viburnum.	White spruce, jack pine, Manchurian crabapple.	Norway spruce, green ash, eastern white pine.	Imperial Carolina poplar.
BIB, BID, BIE— Blue Lake	Lilac, smooth sumac, eastern redcedar, Siberian peashrub, silver buffaloberry, staghorn sumac.	Red pine, jack pine, eastern white pine, Austrian pine.	—	—
BoB, BoD— Bohemian	Arrowwood, common ninebark, nannyberry viburnum, American cranberrybush, northern whitecedar, Roselow sargent crabapple.	White spruce, Siberian crabapple.	Norway spruce, red pine, eastern white pine, green ash.	—
Bp*. Borrow pits				
Bs— Brevort	—	—	—	—
BtA— Brimley	Northern whitecedar, American cranberrybush, silky dogwood, common ninebark, nannyberry viburnum, lilac.	White spruce, Manchurian crabapple.	Norway spruce, eastern white pine, green ash.	Carolina poplar.
Bu. Bruce Variant				
BwC. Burt				
Cb*: Carbondale.				
Lupton—	—	—	—	—
Rifle—	—	—	—	—
Ck*: Cathro.				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--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
Ck*: Tacoosh.				
CmD----- Chatham	Lilac, Siberian peashrub, eastern redcedar, silver buffaloberry, Manchurian crabapple, Roselow sargent crabapple, common ninebark, Peking cotoneaster.	Red pine, eastern white pine, Austrian pine, green ash.	--	--
Cn. Chippeny				
CrA----- Croswell	Amur maple, lilac, eastern redcedar, Siberian peashrub.	Red pine, jack pine--	Eastern white pine--	--
Dd*: Dawson.				
Greenwood.				
DeB, DeD----- Deerton	Siberian peashrub, lilac, eastern redcedar, staghorn sumac, Amur maple, smooth sumac.	Red pine, jack pine, Austrian pine, eastern white pine.	--	--
DIB*: Deerton-----	Siberian peashrub, lilac, eastern redcedar, staghorn sumac, Amur maple, smooth sumac.	Red pine, jack pine, Austrian pine, eastern white pine.	--	--
Burt.				
Dn*, DnG*. Duneland				
EcB, EcD. Adams				
EkB*, EkD*, EkE*: Adams.				
Kalkaska-----	Lilac, silver buffaloberry, smooth sumac, eastern redcedar, Siberian peashrub, staghorn sumac.	Red pine, jack pine, eastern white pine.	--	--

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.—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
Es*: Ensley——	American cranberrybush, Roselow sargent crabapple, silky dogwood, arrowwood, nannyberry viburnum, common ninebark.	White spruce, northern whitecedar.	Eastern white pine, green ash, red maple, Norway spruce.	—
Angelica.				
Gw. Greenwood				
HaB—— Halfaday	Siberian peashrub, lilac, eastern redcedar, staghorn sumac, buffaloberry.	Red pine, jack pine, eastern white pine, Austrian pine.	—	—
IoB—— Iosco	Common ninebark, northern whitecedar, American cranberrybush, nannyberry viburnum, lilac, silky dogwood.	White spruce, Manchurian crabapple.	Green ash, eastern white pine, Norway spruce.	Imperial Carolina poplar.
Jb*: Jacobsville——	—	—	—	—
Burt.				
KaB—— Kalkaska	Lilac, silver buffaloberry, smooth sumac, eastern redcedar, Siberian peashrub, staghorn sumac.	Red pine, jack pine, eastern white pine.	—	—
KaD. Kalkaska				
KaE—— Kalkaska	Lilac, silver buffaloberry, smooth sumac, eastern redcedar, Siberian peashrub, staghorn sumac.	Red pine, jack pine, eastern white pine.	—	—
KaG—— Kalkaksa	Lilac, silver buffaloberry, smooth sumac, eastern redcedar, Siberian peashrub, staghorn sumac.	Red pine, jack pine, eastern white pine.	—	—
KdB, KdD, KdE—— Karlín	Staghorn sumac, lilac, eastern redcedar, Siberian peashrub, smooth sumac.	Red pine, jack pine, eastern white pine, Austrian pine.	—	—
KgC. Kawbawgam				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--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
KmB*: Kalkaska-----	Lilac, silver buffaloberry, smooth sumac, eastern redcedar, Siberian peashrub, staghorn sumac.	Red pine, jack pine, eastern white pine.	--	--
Munising-----	Redosier dogwood, Amur maple, American cranberrybush, common ninebark, northern whitecedar, nannyberry viburnum, lilac, silky dogwood.	White spruce, Norway spruce, eastern white pine, Siberian crabapple.	--	--
KmD*, KmE*: Kalkaska-----	Lilac, silver buffaloberry, smooth sumac, eastern redcedar, Siberian peashrub, staghorn sumac.	Red pine, jack pine, eastern white pine.	--	--
Munising.				
KnB, KnD----- Keweenaw	Lilac, northern whitecedar, Amur maple, Siberian peashrub, Peking cotoneaster.	Manchurian crabapple, white spruce, Norway spruce, jack pine.	Red pine, eastern white pine.	Imperial Carolina poplar.
Kr. Kinross				
Lb*. Lake beaches				
McB----- 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.
Mh*. Marsh				
MuB, MuD----- Munising	Redosier dogwood, Amur maple, American cranberrybush, common ninebark, northern whitecedar, nannyberry viburnum, lilac, silky dogwood.	White spruce, Norway spruce, eastern white pine, Siberian crabapple.	--	--
MuE. Munising				
Nh. Nahma				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.—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
OoE*: Onota————	Roselow sargent crabapple, lilac, Manchurian crabapple, eastern redcedar, Amur maple, common ninebark, Siberian peashrub.	Eastern white pine, red pine, jack pine, green ash, Austrian pine.	—	—
Chippeny.				
OrB*, OrD*: Onota————	Roselow sargent crabapple, lilac, Manchurian crabapple, eastern redcedar, Amur maple, common ninebark, Siberian peashrub.	Eastern white pine, red pine, jack pine, green ash, Austrian pine.	—	—
Deerton————	Siberian peashrub, lilac, eastern redcedar, staghorn sumac, Amur maple, smooth sumac.	Red pine, jack pine, Austrian pine, eastern white pine.	—	—
OtB———— Otisco	American cranberrybush, Roselow sargent crabapple, silky dogwood, common ninebark, arrowwood, nannyberry viburnum.	Northern whitecedar, white spruce, Manchurian crabapple.	Green ash, Norway spruce, eastern white pine.	—
Rc. Roscommon				
RkB*: Roscommon.				
Kalkaska————	Lilac, silver buffaloberry, smooth sumac, eastern redcedar, Siberian peashrub, staghorn sumac.	Red pine, jack pine, eastern white pine.	—	—
RuB, RuD, RuE— Rubicon	Eastern redcedar, smooth sumac, silver buffaloberry, lilac, Siberian peashrub, staghorn sumac.	Red pine, eastern white pine, jack pine.	—	—
ShB. Shelldrake				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--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
SkB----- Skaneec	Nannyberry viburnum, silky dogwood, American cranberrybush, northern whitecedar, lilac, Roselow sargent crabapple.	White spruce, Norway spruce, Siberian crabapple.	Eastern white pine, red maple, green ash.	--
StB, StD----- Steuben	Silky dogwood, American cranberrybush, Amur maple, lilac, arrowwood.	White spruce, Austrian pine, Siberian crabapple, red pine, eastern white pine, Norway spruce.	Green ash-----	--
SvA----- Sundell	--	--	--	--
SwA Sundell Variant				
Ta----- Tawas	Black spruce, silky dogwood, nannyberry viburnum, common ninebark, redosier dogwood, arrowwood.	Northern whitecedar, green ash.	--	--
TrB, TrD----- Trenary	Northern whitecedar, arrowwood, common ninebark, silky dogwood, eastern redcedar.	White spruce, Siberian crabapple, Norway spruce, red maple.	Eastern white pine, red pine.	Imperial Carolina poplar.
WaA----- Wainola	Northern whitecedar, common ninebark, lilac, nannyberry viburnum, American cranberrybush, Amur privet.	White spruce, jack pine, Manchurian crabapple.	Norway spruce, eastern white pine.	--
YaB, YaD----- Yalmer	Silky dogwood, Amur maple, gray dogwood, American cranberrybush, nannyberry viburnum, Siberian peashrub.	White spruce, Norway spruce, Siberian crabapple, red pine.	Eastern white pine---	--

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--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
Adams	Sandy, mixed, frigid Typic Haplorthods
Alluvial land	Fluvaquents
Angelica	Fine-loamy, mixed, nonacid, frigid Aeric Endoaquepts
Assinins	Coarse-loamy, mixed, frigid Argic Endoaquods
Au Gres	Sandy, mixed, frigid Typic Endoaquods
*Blue Lake	Sandy, mixed, frigid Alfic Haplorthods
Bohemian	Fine-loamy, mixed, frigid Alfic Haplorthods
*Brevort	Sandy over loamy, mixed, nonacid, frigid Mollic Endoaquents
Brimley	Fine-loamy, mixed, frigid Argic Endoaquods
Bruce Variant	Coarse-loamy, mixed, nonacid, frigid Aeric Endoaquepts
*Burt	Siliceous, frigid Lithic Psammaquents
Carbondale	Euic Hemic Borosaprists
Cathro	Loamy, mixed, euic Terric Borosaprists
Chatham	Coarse-loamy, mixed, frigid Typic Haplorthods
Chippeny	Euic Lithic Borosaprists
Croswell	Sandy, mixed, frigid Oxyaquic Haplorthods
Dawson	Sandy or sandskeletal, mixed, dysic Terric Borosaprists
Deerton	Sandy, mixed, frigid Entic Haplorthods
Ensley	Coarse-loamy, mixed, nonacid, frigid Aeric Endoaquepts
Greenwood	Dysic Typic Borohemists
Halfaday	Sandy, mixed, frigid Typic Haplorthods
Iosco	Sandy over loamy, mixed, frigid Argic Endoaquods
Jacobsville	Coarse-loamy, mixed, nonacid, frigid Typic Endoaquepts
Kalkaksa	Sandy, mixed, frigid Typic Haplorthods
Karlin	Sandy, mixed, frigid Entic Haplorthods
Kawbawgam	Coarse-loamy, mixed, frigid Typic Endoaquods
Keweenaw	Sandy, mixed, frigid Alfic Haplorthods
Kinross	Sandy, mixed, frigid Typic Endoaquods
Lupton	Euic Typic Borosaprists
Mancelona	Sandy, mixed, frigid Alfic Haplorthods
Munising	Coarse-loamy, mixed, frigid Oxyaquic Fragiorthods
Nahma	Coarse-loamy, mixed, nonacid, frigid Histic Humaquepts
Onota	Coarse-loamy, mixed, frigid Typic Haplorthods
Otisco	Sandy, mixed, frigid Argic Endoaquods
Rifle	Euic Typic Borohemists
Roscommon	Mixed, frigid Mollic Psammaquents
Rubicon	Sandy, mixed, frigid Entic Haplorthods
Shelldrake	Frigid, uncoated Typic Quartzipsamments
Skanee	Coarse-loamy, mixed, frigid Argic Fragiaquods
Steuben	Coarse-loamy, mixed, frigid Oxyaquic Fragiorthods
Sundell	Coarse-loamy, mixed Aquic Haploborolls
Sundell Variant	Sandy, mixed, frigid Typic Endoaquods
Tacoosh	Loamy, mixed, euic Terric Borohemists
Tawas	Sandy or sandskeletal, mixed, euic Terric Borosaprists
Trenary	Coarse-loamy, mixed, frigid Alfic Haplorthods
*Wainola	Sandy, mixed, frigid Typic Endoaquods
Yalmer	Sandy, mixed, frigid Oxyaquic Fragiorthods

TABLE 15.--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
BoB	Bohemian fine sandy loam, 0 to 6 percent slopes
BtA	Brimley fine sandy loam, 0 to 4 percent slopes (where drained)
Es	Ensley and Angelica soils (where drained)
TrB	Trenary fine sandy loam, 2 to 6 percent slopes

SOIL LEGEND

Symbol	Map Unit Name	Symbol	Map Unit Name
Ad	ALLUVIAL LAND	KaG	KALKASKA SAND, 40 TO 80 PERCENT SLOPES
AaA	ASSININS SAND, 0 TO 3 PERCENT SLOPES	KdB	KARLIN SANDY LOAM, 0 TO 6 PERCENT SLOPES
AuB	AU GRES SAND, 0 TO 6 PERCENT SLOPES	KdD	KARLIN SANDY LOAM, 6 TO 18 PERCENT SLOPES
BiB	BLUE LAKE SAND, 0 TO 6 PERCENT SLOPES	KdE	KARLIN SANDY LOAM, 18 TO 40 PERCENT SLOPES
BID	BLUE LAKE SAND, 6 TO 18 PERCENT SLOPES	KgC	KAWBAWGAM SANDY LOAM, 0 TO 10 PERCENT SLOPES
BIE	BLUE LAKE SAND, 18 TO 40 PERCENT SLOPES	KmB	KALKASKA-MUNISING COMPLEX, DISSECTED, 1 TO 12 PERCENT SLOPES
BoB	BOHEMIAN FINE SANDY LOAM, 0 TO 6 PERCENT SLOPES	KmD	KALKASKA-MUNISING COMPLEX, DISSECTED, 8 TO 35 PERCENT SLOPES
BoD	BOHEMIAN FINE SANDY LOAM, 6 TO 18 PERCENT SLOPES	KmE	KALKASKA-MUNISING COMPLEX, DISSECTED, 15 TO 60 PERCENT SLOPES
Bp	BORROW PITS	KnB	KEWEENAW LOAMY SAND, 0 TO 6 PERCENT SLOPES
Bs	BREVORT MUCKY LOAMY SAND	KnD	KEWEENAW LOAMY SAND, 6 TO 18 PERCENT SLOPES
BtA	BRIMLEY FINE SANDY LOAM, 0 TO 4 PERCENT SLOPES	Kr	KINROSS MUCKY SAND
Bu	BRUCE MUCKY FINE SANDY LOAM, COARSE VARIANT	Lb	LAKE BEACHES
BwC	BURT MUCKY SANDY LOAM, 2 TO 12 PERCENT SLOPES	McB	MANCELONA LOAMY SAND, 0 TO 6 PERCENT SLOPES
Cb	CARBONDALE, LUPTON, AND RIFLE SOILS	Mh	MARSH
Ck	CATHRO AND TACOOSH MUCKS	MuB	MUNISING SANDY LOAM, 0 TO 6 PERCENT SLOPES
CmD	CHATHAM FINE SANDY LOAM, 6 TO 18 PERCENT SLOPES	MuD	MUNISING SANDY LOAM, 6 TO 18 PERCENT SLOPES
Cn	CHIPPENY MUCK	MuE	MUNISING SANDY LOAM, 18 TO 40 PERCENT SLOPES
CrA	CROSWELL SAND, 0 TO 4 PERCENT SLOPES	Nh	NAHMA MUCK
Dd	DAWSON AND GREENWOOD PEATS	OoE	ONOTA-CHIPPENY COMPLEX, 0 TO 35 PERCENT SLOPES
DeB	DEERTON SAND, 0 TO 6 PERCENT SLOPES	OrB	ONOTA-DEERTON COMPLEX, 0 TO 6 PERCENT SLOPES
DeD	DEERTON SAND, 6 TO 18 PERCENT SLOPES	OrD	ONOTA-DEERTON COMPLEX, 6 TO 18 PERCENT SLOPES
DIB	DEERTON-BURT COMPLEX, 0 TO 6 PERCENT SLOPES	OB	OTISCO LOAMY SAND, 0 TO 6 PERCENT SLOPES
Dn	DUNELAND, MODERATELY SLOPING TO STEEP	Rc	ROSCOMMON MUCKY SAND
DnG	DUNELAND, VERY STEEP	RkB	ROSCOMMON-KALKASKA SANDS, 0 TO 6 PERCENT SLOPES
EcB	ADAMS LOAMY SAND, 0 TO 6 PERCENT SLOPES	RuB	RUBICON SAND, 0 TO 6 PERCENT SLOPES
EcD	ADAMS LOAMY SAND, 6 TO 18 PERCENT SLOPES	RuD	RUBICON SAND, 6 TO 18 PERCENT SLOPES
EkB	ADAMS-KALKASKA COMPLEX, 0 TO 6 PERCENT SLOPES	RuE	RUBICON SAND, 18 TO 40 PERCENT SLOPES
EkD	ADAMS-KALKASKA COMPLEX, 6 TO 18 PERCENT SLOPES	ShB	SHELLDRAKE SAND, 0 TO 8 PERCENT SLOPES
EkE	ADAMS-KALKASKA COMPLEX, 18 TO 40 PERCENT SLOPES	SkB	SKANEE SANDY LOAM, 0 TO 6 PERCENT SLOPES
Es	ENSLEY AND ANGELICA SOILS	SiB	STEBEN FINE SANDY LOAM, 0 TO 6 PERCENT SLOPES
Gw	GREENWOOD PEAT	SiD	STEBEN FINE SANDY LOAM, 6 TO 18 PERCENT SLOPES
HaB	HALFADAY SAND, 0 TO 4 PERCENT SLOPES	SvA	SUNDELL FINE SANDY LOAM, 0 TO 4 PERCENT SLOPES
IoB	IOSCO SAND, 0 TO 6 PERCENT SLOPES	SwA	SUNDELL LOAMY FINE SAND, SANDY VARIANT, 0 TO 4 PERCENT SLOPES
Jb	JACOBSVILLE-BURT COMPLEX	Ta	TAWAS MUCK
KaB	KALKASKA SAND, 0 TO 6 PERCENT SLOPES	TtB	TRENARY FINE SANDY LOAM, 2 TO 6 PERCENT SLOPES
KaD	KALKASKA SAND, 6 TO 18 PERCENT SLOPES	TtD	TRENARY FINE SANDY LOAM, 12 TO 18 PERCENT SLOPES
KaE	KALKASKA SAND, 18 TO 40 PERCENT SLOPES	WaA	WAINOLA FINE SAND, 0 TO 4 PERCENT SLOPES
		YaB	YALMER SAND, 0 TO 6 PERCENT SLOPES
		YaD	YALMER SAND, 6 TO 18 PERCENT SLOPES

PICTURED ROCKS NATIONAL LAKESHORE

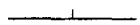
CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

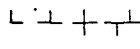
BOUNDARIES

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 & neatline	
Fee Zone Boundary	

STATE COORDINATE TICK



LAND DIVISION CORNERS (sections and land grants)



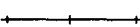
ROADS

Divided (median shown if scale permits)	
Other roads	
Trail	

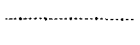
ROAD EMBLEMS & DESIGNATIONS

Interstate	
Federal	
State	
County, farm or ranch	

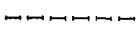
RAILROAD



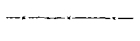
POWER TRANSMISSION LINE (normally not shown)



PIPE LINE (normally not shown)



FENCE (normally not shown)



LEVEES

Without road	
With road	
With railroad	

DAMS

Large (to scale)	
Medium or small	

PITS

Gravel pit	
Mine or quarry	

MISCELLANEOUS CULTURAL FEATURES

Farmstead, house (omit in urban areas)	
Church	
Visitor Center or Ranger Station	
Indian mound (label)	
Located object (label)	
Tank (label)	
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)	
Drainage and/or irrigation	

LAKES, PONDS AND RESERVOIRS

Perennial	
Intermittent	

MISCELLANEOUS WATER FEATURES

Marsh or swamp	
Spring	
Well, artesian	
Well, irrigation	
Wet spot	

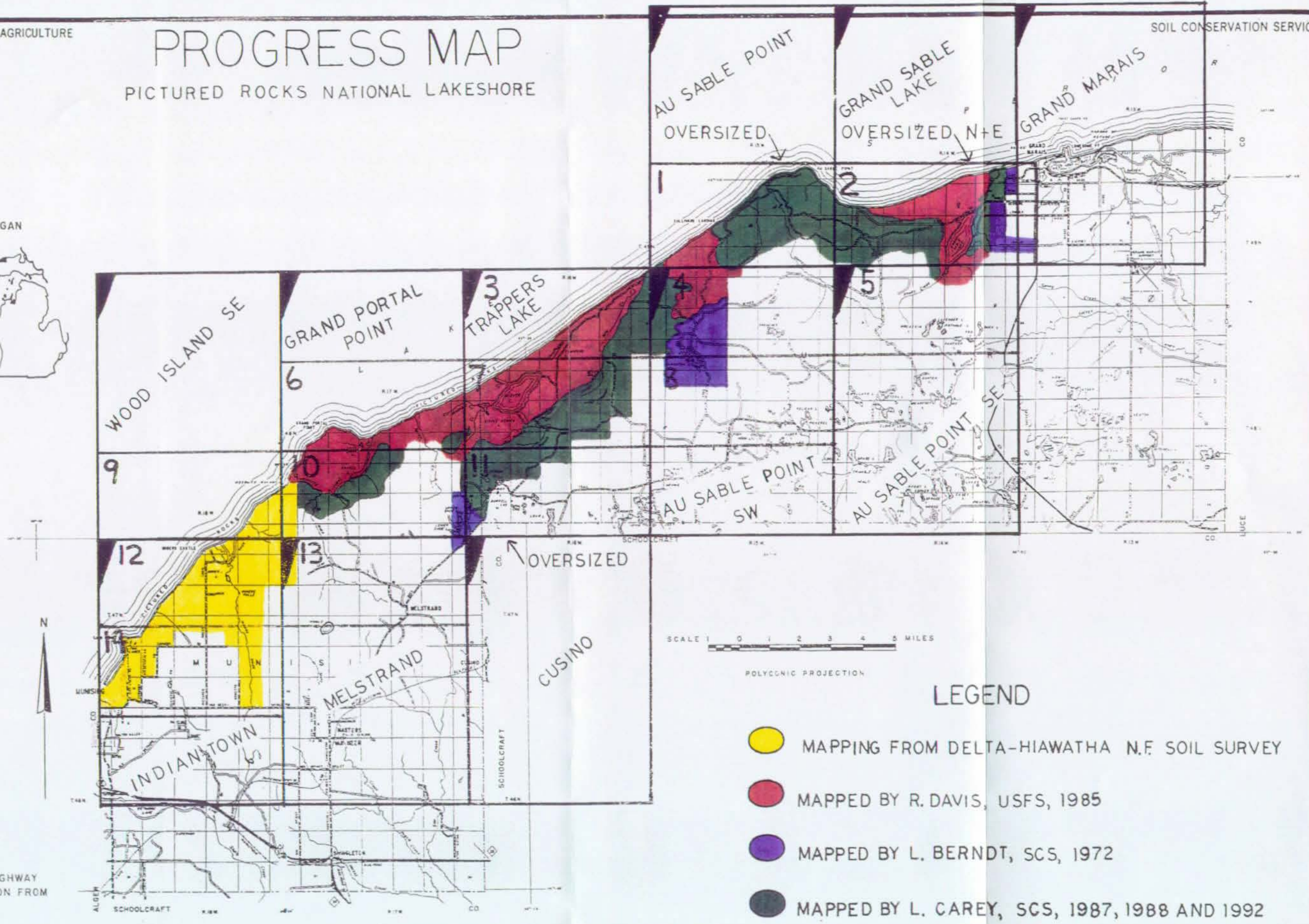
SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS	
Bedrock (points down slope)	
Other than bedrock (points down slope)	
SHORT STEEP SLOPE	
GULLY	
DEPRESSION OR SINK	
SOIL SAMPLE SITE (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	
Small area of well drained soil in poorly drained or somewhat poorly drained soil area, less than 5 acres	
Small area of organic soil within a mineral soil, less than 5 acres	
Campground	
Bedrock < 40 inches	

PROGRESS MAP

PICTURED ROCKS NATIONAL LAKESHORE



SCALE 1 0 1 2 3 4 5 MILES

POLYCONIC PROJECTION

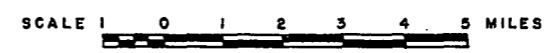
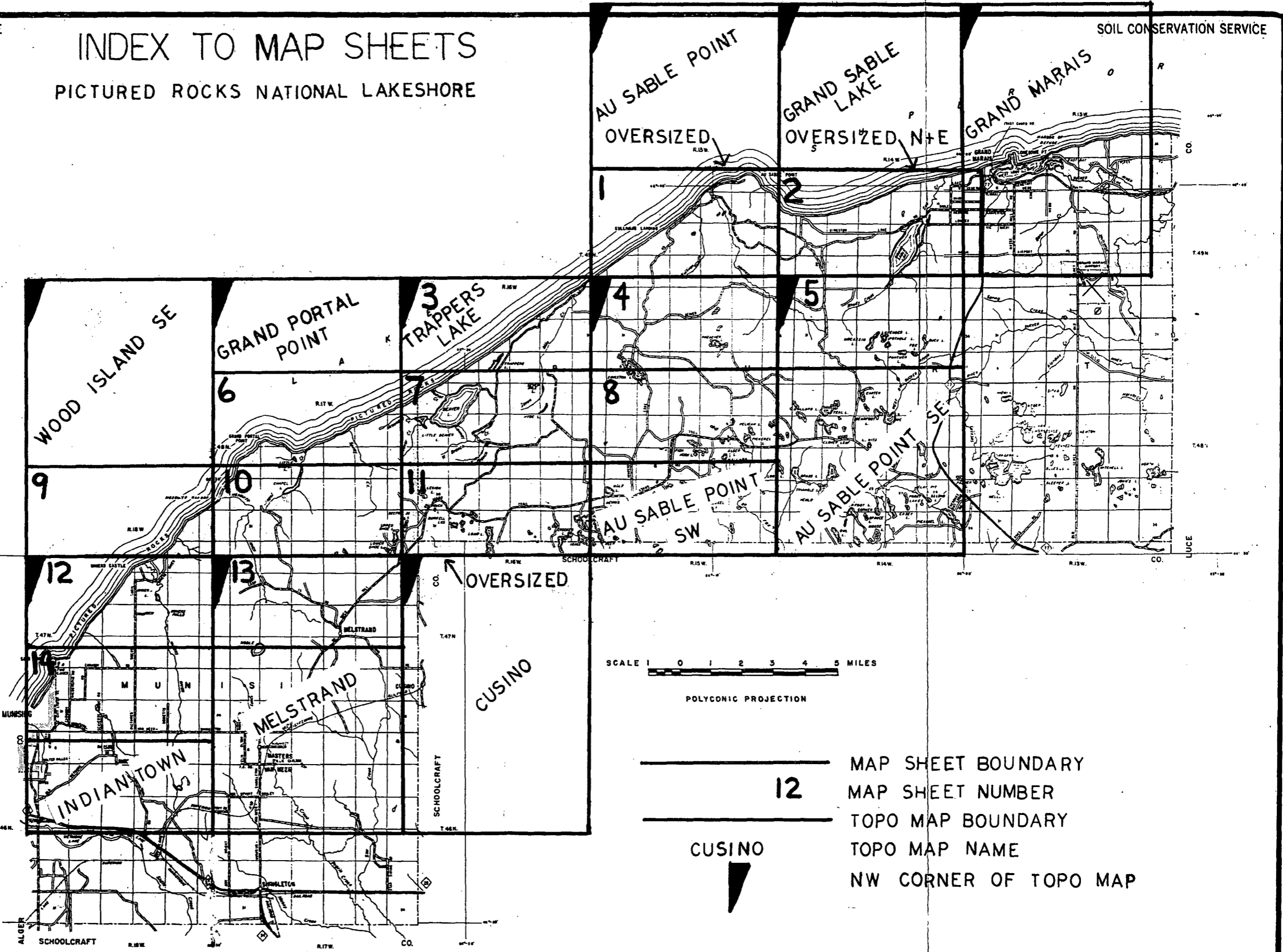
LEGEND

- MAPPING FROM DELTA-HIAWATHA N.E. SOIL SURVEY
- MAPPED BY R. DAVIS, USFS, 1985
- MAPPED BY L. BERNDT, SCS, 1972
- MAPPED BY L. CAREY, SCS, 1987, 1988 AND 1992






SOURCE:
MICHIGAN GENERAL HIGHWAY
MAPS AND INFORMATION FROM
FIELD TECHNICIANS.

INDEX TO MAP SHEETS

PICTURED ROCKS NATIONAL LAKESHORE



POLYCONIC PROJECTION

-  MAP SHEET BOUNDARY
-  MAP SHEET NUMBER
-  TOPO MAP BOUNDARY
-  TOPO MAP NAME
-  NW CORNER OF TOPO MAP

SOURCE:
MICHIGAN GENERAL HIGHWAY
MAPS AND INFORMATION FROM
FIELD TECHNICIANS.



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981-1983 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2



86° 7' 30" 46° 40' 00"

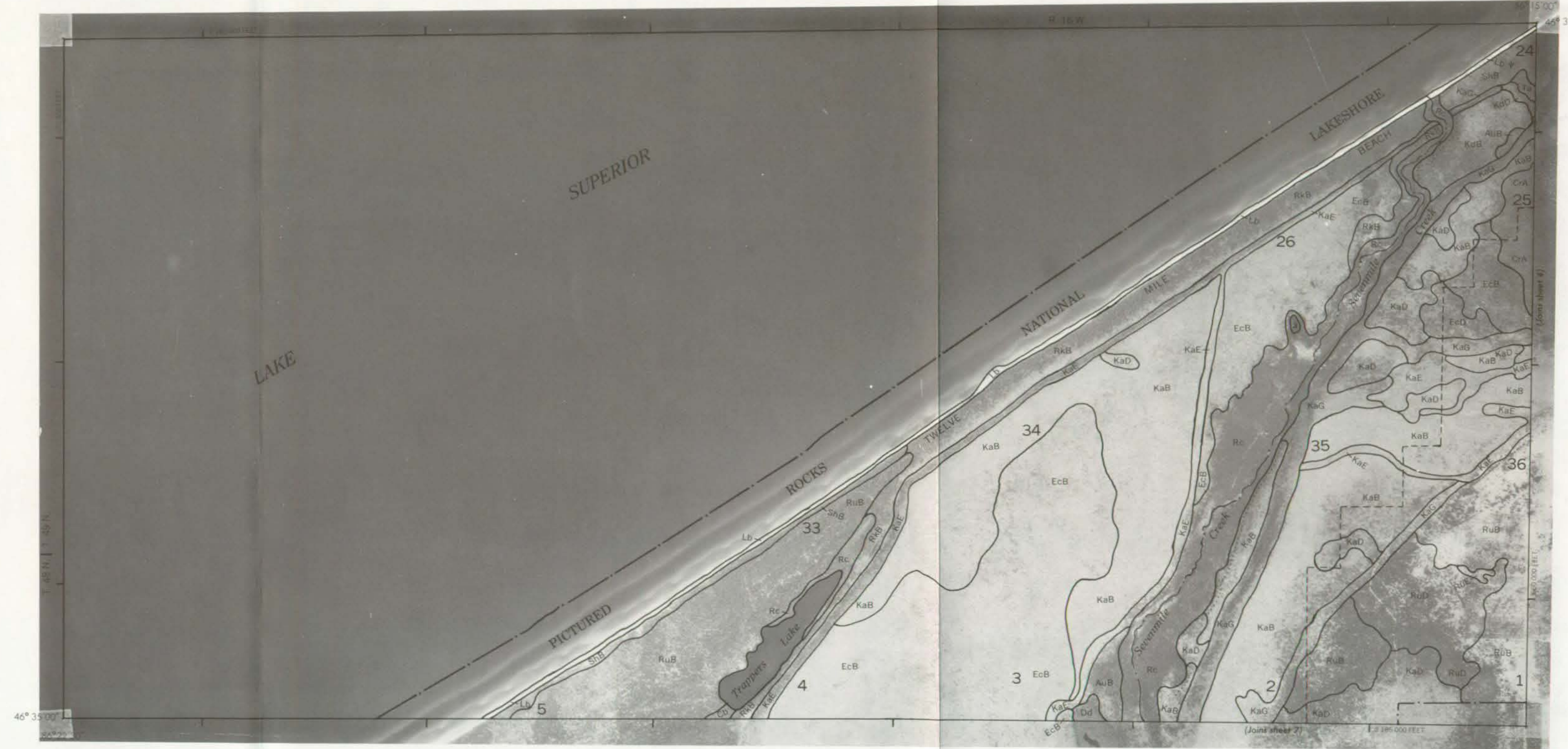


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NOMINAL
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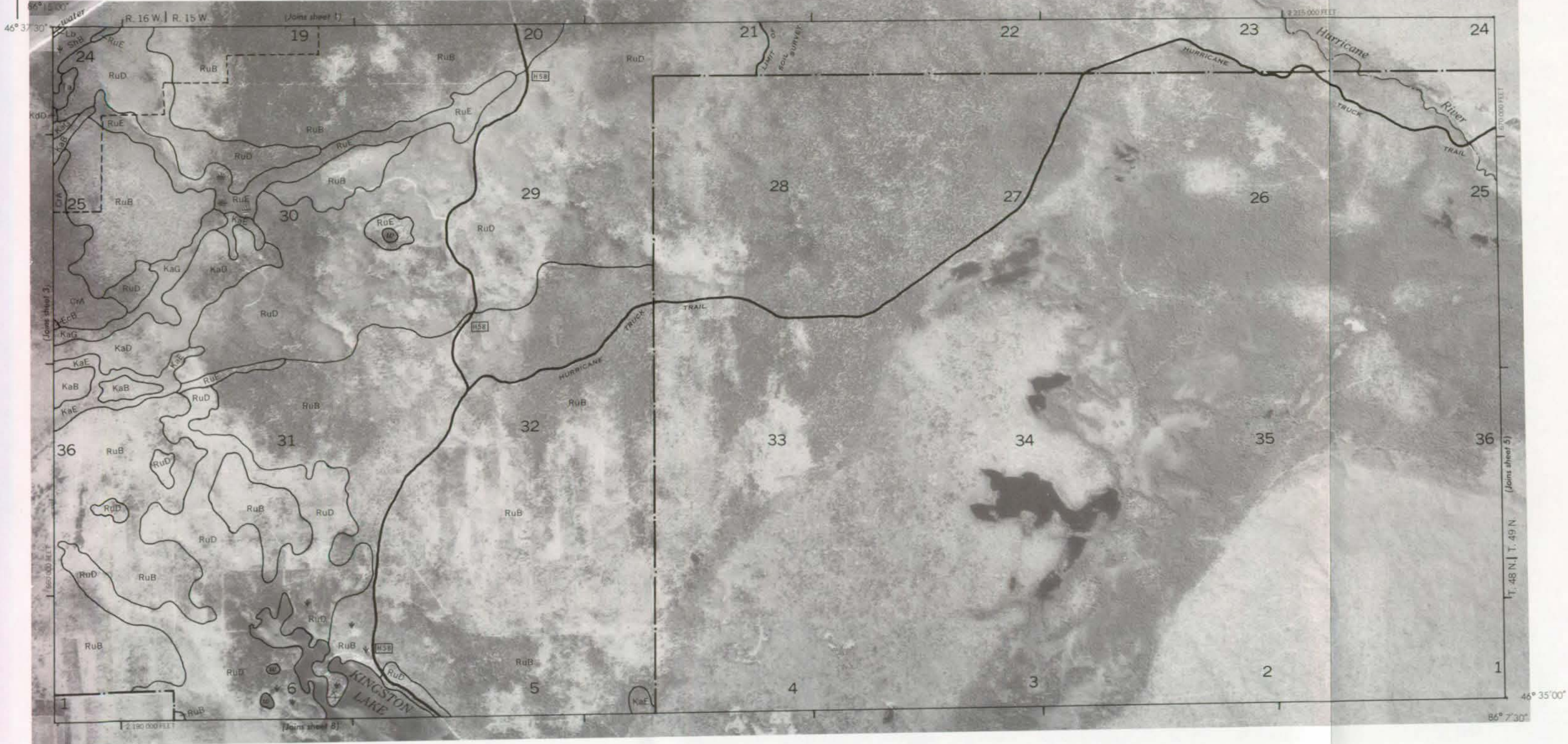


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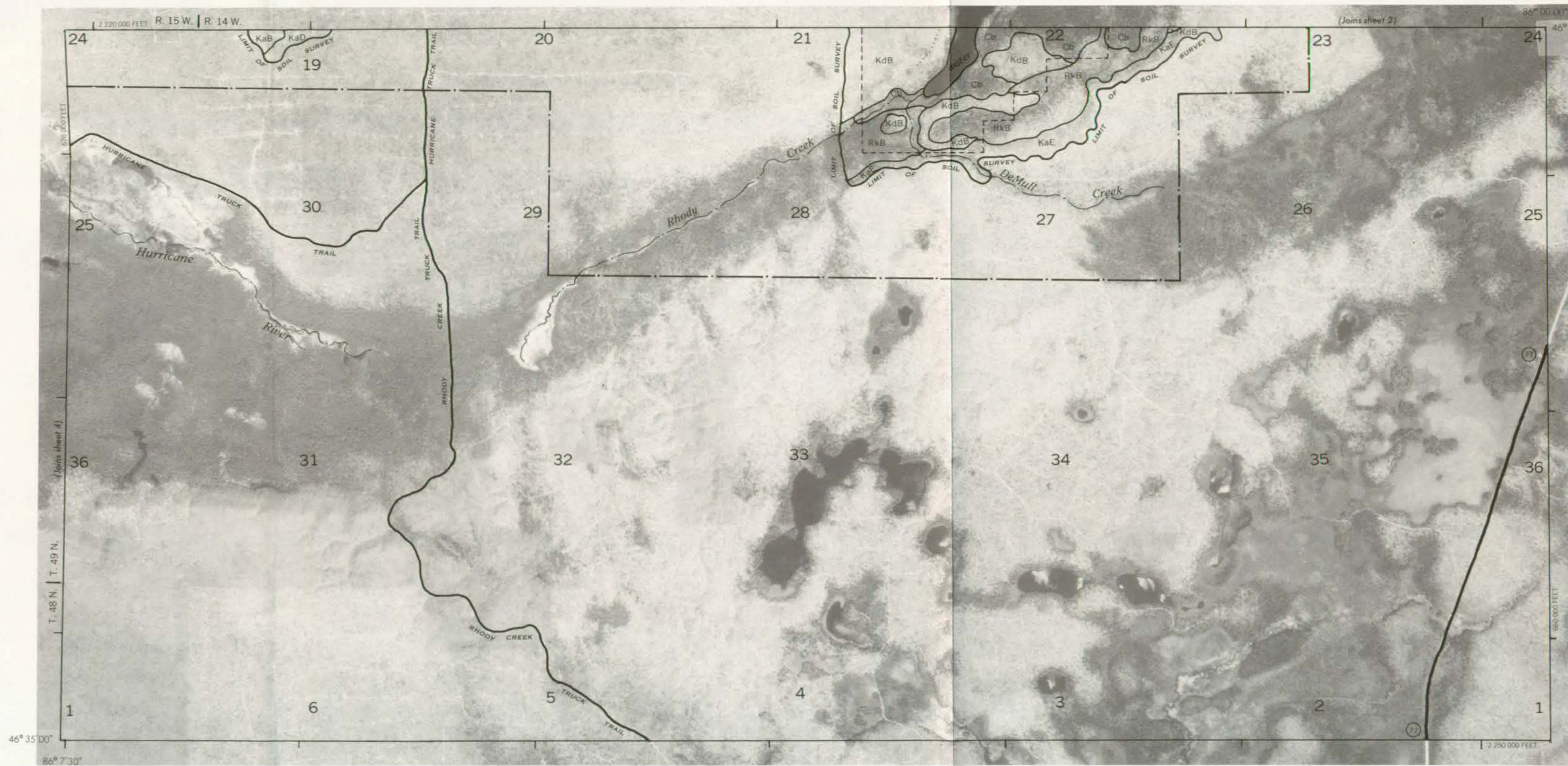
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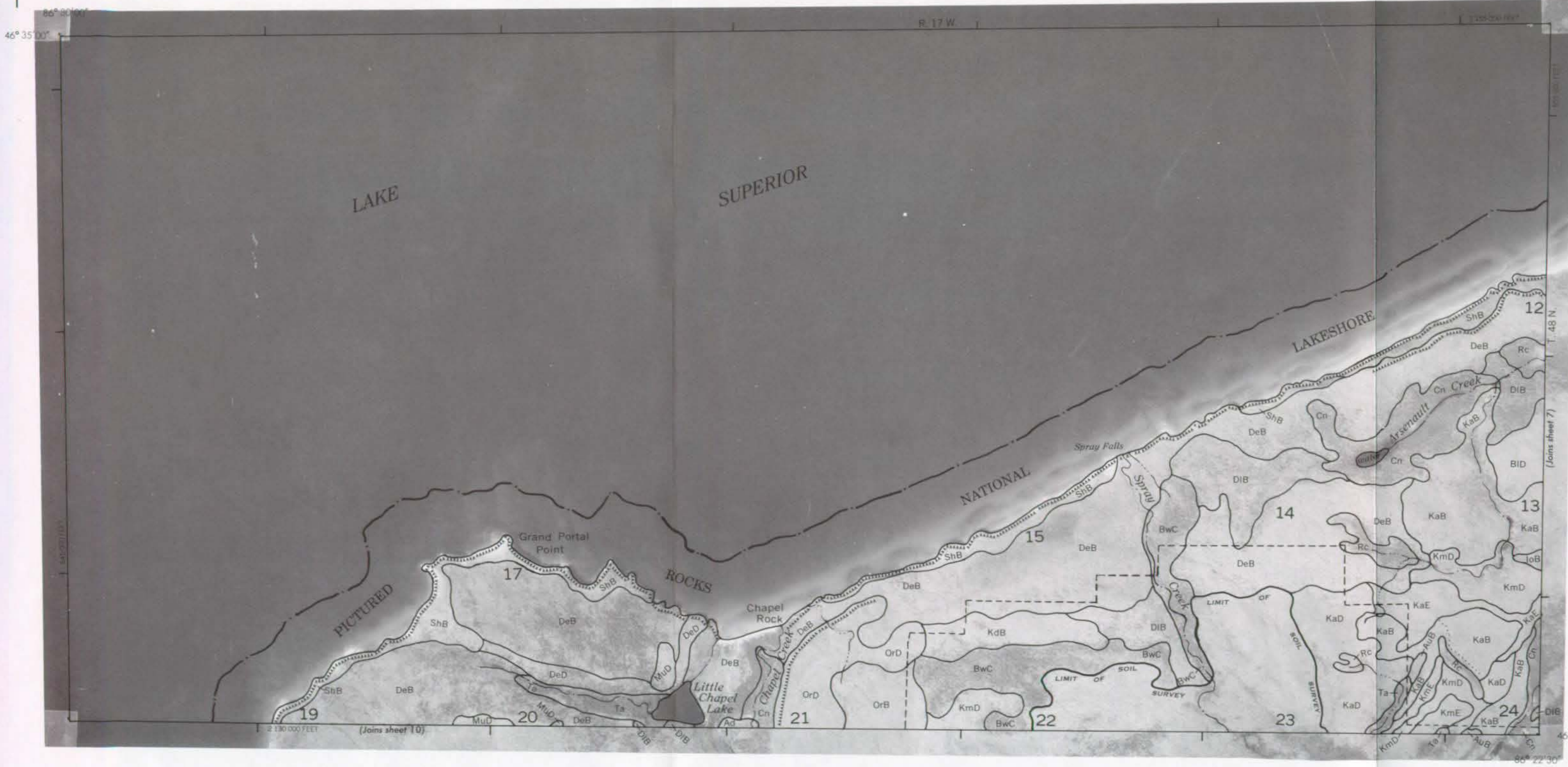
4



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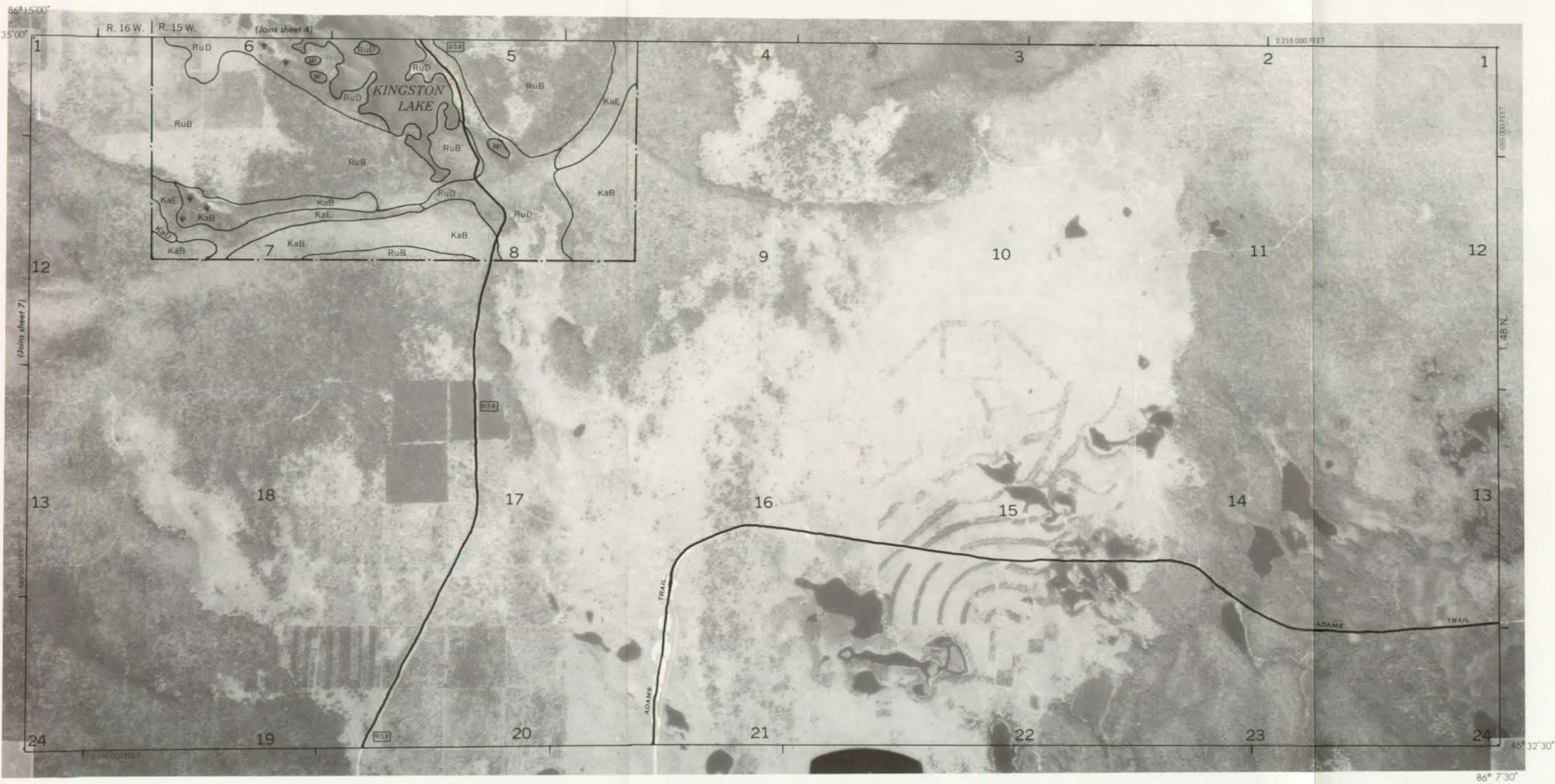
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NOMINAL
SCALE 1:24 000

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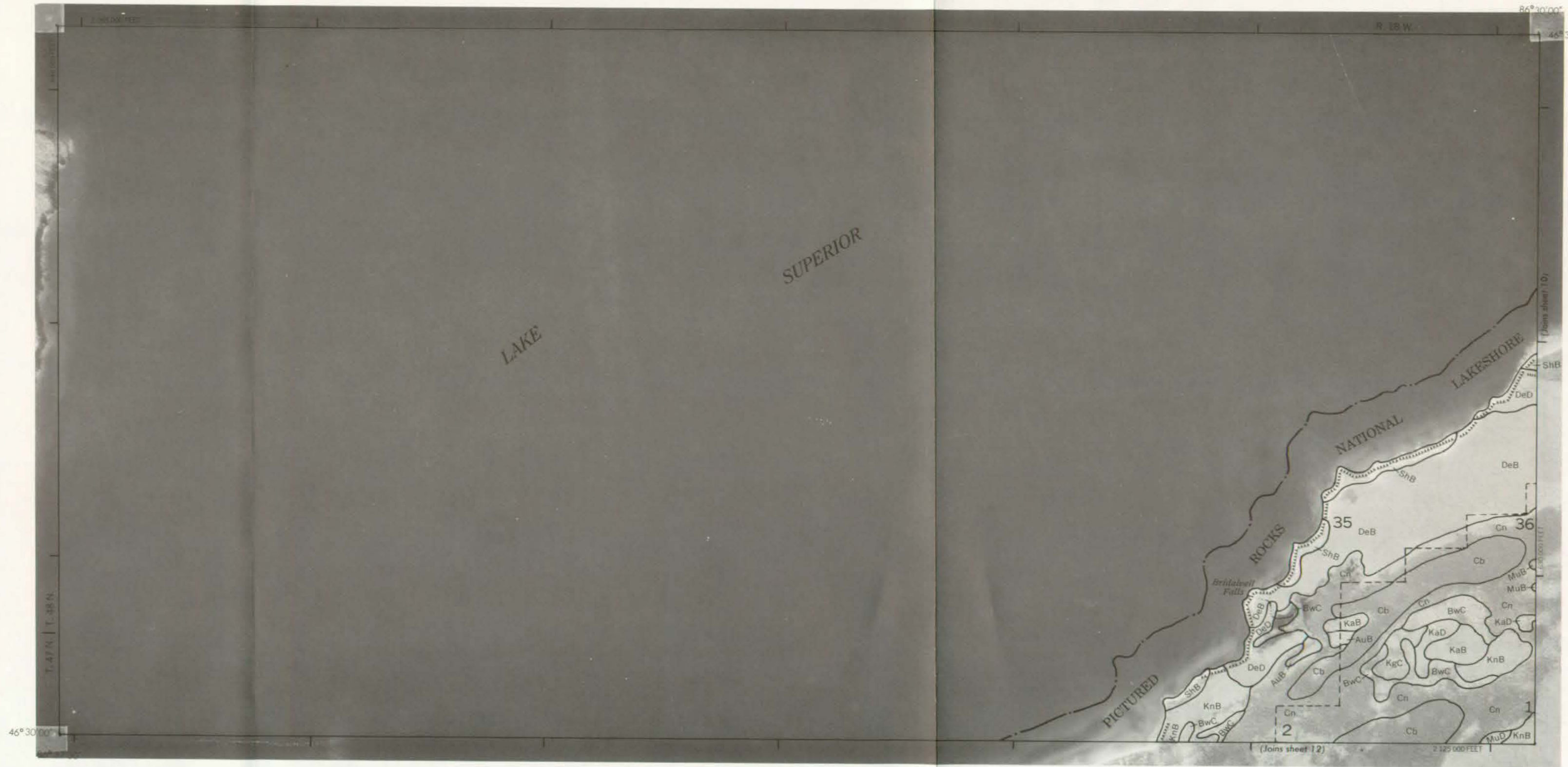


8



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10



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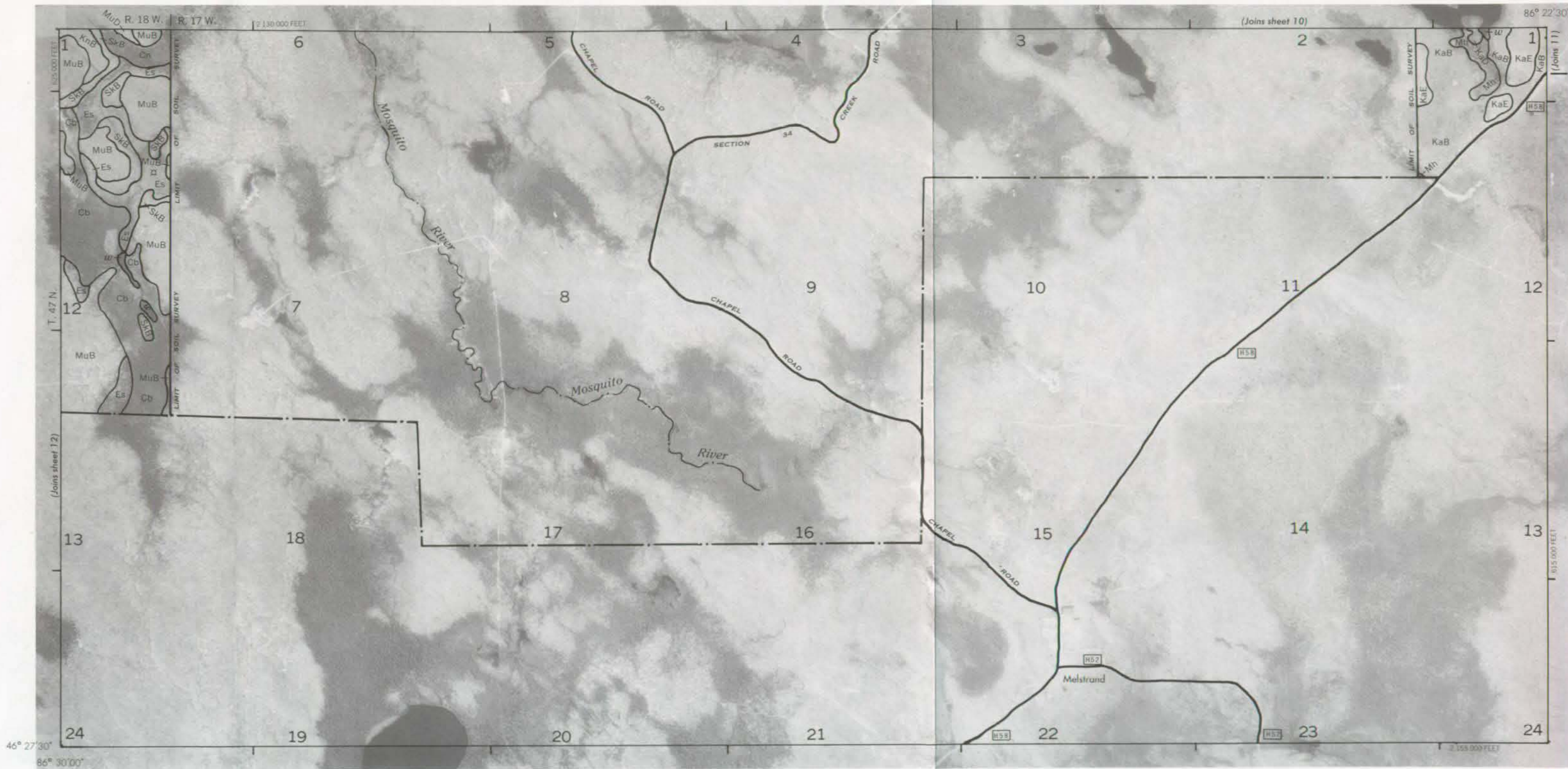
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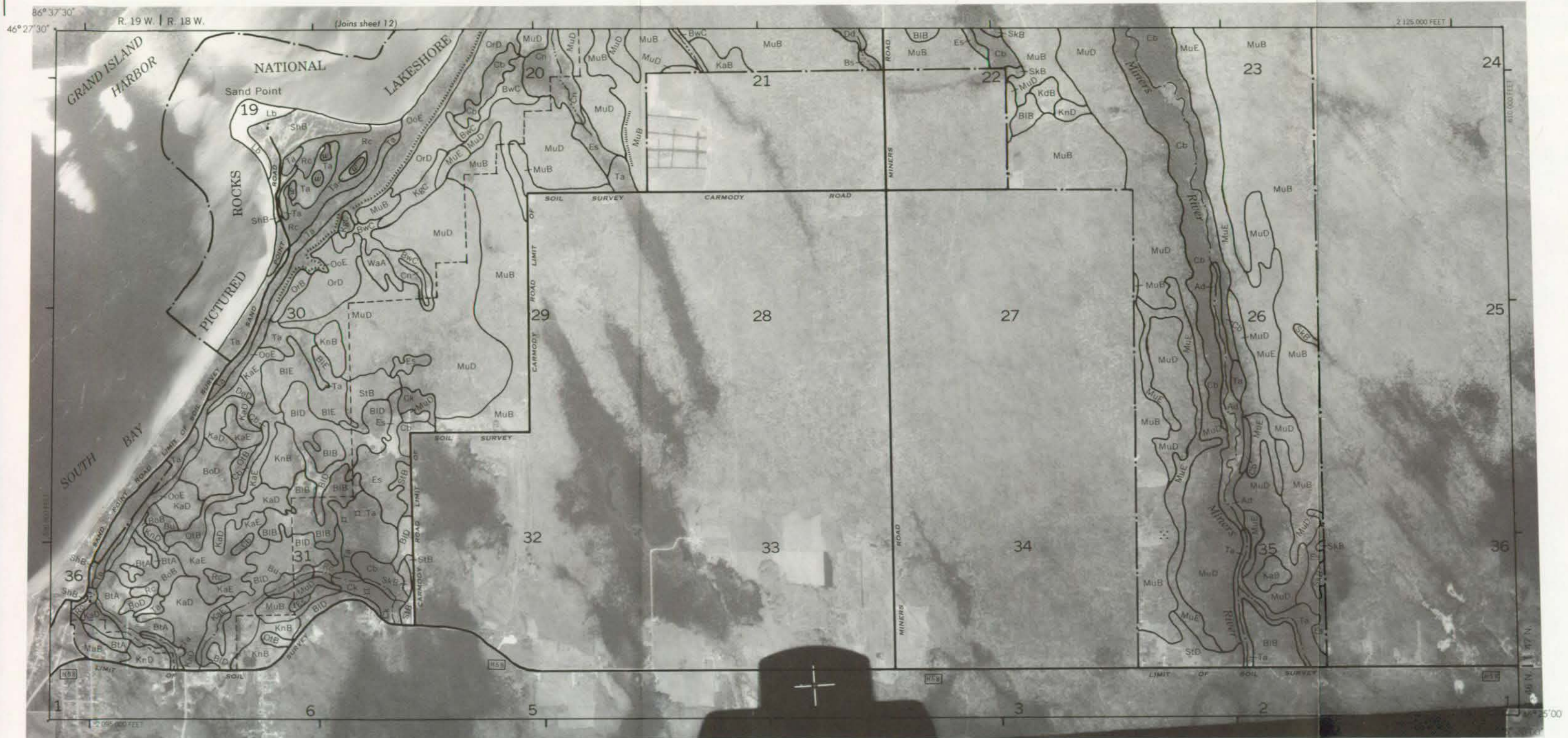
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NOMINAL
SCALE 1:24 000



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