



United States  
Department of  
Agriculture

Natural  
Resources  
Conservation  
Service

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

# Soil Survey of Iosco County, Michigan





# How to Use This Soil Survey

## General Soil Map

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

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

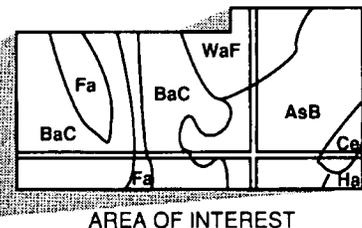
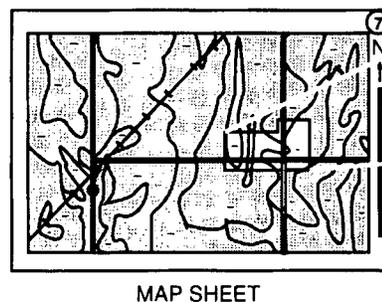
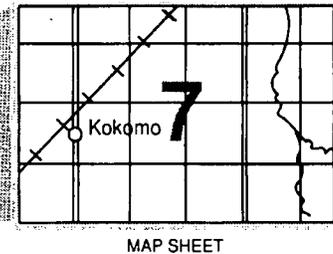
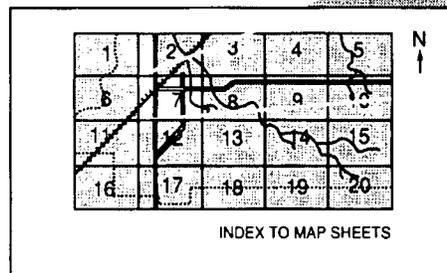
## Detailed Soil Maps

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

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

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

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



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

---

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

Major fieldwork for this soil survey was completed in 1994. Soil names and descriptions were approved in 1995. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1994. This survey was made cooperatively by the Natural Resources Conservation Service and the Forest Service, the Michigan Department of Agriculture, the Michigan Agricultural Experiment Station, Michigan State University Extension, and Michigan Technological University. The survey is part of the technical assistance furnished to the Iosco County Board of Commissioners and the Iosco County Soil and Water Conservation District. The Iosco County Board of Commissioners provided financial assistance.

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.

The United States Department of Agriculture (USDA) prohibits discrimination in all of its programs on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact the USDA's TARGET Center at 202-720-2600 (voice or TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326W, Whitten Building, 14th and Independence Avenue SW, Washington, DC 20250-9410, or call 202-720-5964 (voice or TDD). USDA is an equal opportunity provider and employer.

**Cover: The Tawas Point Lighthouse is maintained by the U.S. Coast Guard.**

*Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is <http://www.nrcs.usda.gov> (click on "Technical Resources").*

# Contents

---

<b>How to Use This Soil Survey</b> .....	3
<b>Foreword</b> .....	11
<b>General Nature of the County</b> .....	13
History and Development .....	13
Climate .....	14
Lakes and Streams .....	14
Farming .....	17
Industry and Transportation Facilities .....	17
Physiography .....	17
<b>How This Survey Was Made</b> .....	17
Survey Procedures .....	20
Procedures for Map Units 1 to 199 and 300 to 449 .....	20
Procedures for Map Units 200 to 299 .....	21
<b>General Soil Map Units</b> .....	23
1. Au Gres-Tawas-Wurtsmith Association .....	23
2. Deer Park-Meehan-Wurtsmith Association .....	24
3. Finch-Deford-Proper Association .....	25
4. Deford-Tawas-Lupton Association .....	26
5. Borosapristis-Typic Udipsamments- Croswell Association .....	26
6. Grayling Association .....	27
7. Au Gres-Croswell-Rubicon Association .....	27
8. Manary-Whittemore-largo Association .....	28
9. Algonquin-Allendale-Springport Association .....	28
10. McIvor-Wakeley Association .....	29
11. Udorthents Association .....	30
12. Selkirk-Kent Association .....	30
13. Kawkawlin-Nester Association .....	31
14. Morganlake-Nester Association .....	31
15. Glennie-Sprinkler Association .....	32
16. Kawkawlin-Allendale-Nester Association ...	32
17. Kawkawlin-Sims Association .....	33
<b>Detailed Soil Map Units</b> .....	35
12B—Tawas-Au Gres complex, 0 to 4 percent slopes .....	36
13—Tawas-Lupton mucks .....	37
15A—Croswell-Au Gres sands, 0 to 3 percent slopes .....	38
16B—Graycalm sand, 0 to 6 percent slopes .....	39
16D—Graycalm sand, 12 to 18 percent slopes .....	40
17B—Croswell sand, 0 to 6 percent slopes .....	41
18A—Au Gres sand, 0 to 3 percent slopes .....	42
19—Leafriver muck .....	44
25B—Kent sandy loam, 2 to 6 percent slopes ....	44
25C—Kent sandy loam, 6 to 12 percent slopes .....	46
26B—Cublake sand, 0 to 6 percent slopes .....	47
27A—Tacoda sand, 0 to 3 percent slopes .....	48
28B—East Lake sand, 0 to 6 percent slopes .....	49
39B—Glennie loamy sand, 0 to 6 percent slopes .....	50
39C—Glennie loamy sand, 6 to 12 percent slopes .....	51
40A—Sprinkler sandy loam, 0 to 3 percent slopes .....	53
47D—Graycalm sand, 6 to 18 percent slopes .....	54
47F—Graycalm sand, 18 to 45 percent slopes .....	55
53B—Negwegon silt loam, 2 to 6 percent slopes .....	56
53C—Negwegon silt loam, 6 to 12 percent slopes .....	57
54A—Algonquin silt loam, 0 to 3 percent slopes .....	58
55—Springport clay loam .....	59
56C—Nester loam, 6 to 12 percent slopes .....	61
57B—Kawkawlin loam, 1 to 4 percent slopes .....	62
58A—Wakeley-Allendale complex, 0 to 3 percent slopes .....	63
59B—Algonquin-Springport complex, 0 to 6 percent slopes .....	65
62A—Allendale loamy sand, 0 to 3 percent slopes .....	66
70—Lupton muck .....	68
71—Tawas muck .....	69
72—Dorval muck .....	69
75B—Rubicon sand, 0 to 6 percent slopes .....	70
75D—Rubicon sand, 6 to 18 percent slopes .....	71
75E—Rubicon sand, 18 to 35 percent slopes .....	72
75F—Rubicon sand, 35 to 70 percent slopes .....	73
77—Rollaway muck, frequently flooded .....	74
78—Pits, borrow .....	75
81B—Grayling sand, 0 to 6 percent slopes .....	75
81D—Grayling sand, 6 to 18 percent slopes .....	76
81E—Grayling sand, 18 to 35 percent slopes ....	77

82C—Udorthents, loamy, nearly level to gently rolling .....	77	210E—Grayling sand, steep .....	103
82F—Udorthents, loamy, very steep .....	78	211B—Grayling sand, banded substratum, nearly level and undulating .....	104
83B—Udipsamments, nearly level and undulating .....	78	212B—Grayling sand, very deep water table, nearly level and undulating .....	105
84B—Zimmerman loamy fine sand, 0 to 6 percent slopes .....	79	213B—Graycalm sand, nearly level and undulating .....	106
86—Histosols and Aquents, ponded .....	80	214B—Typic Udipsamments, deep water table, nearly level and undulating .....	106
93B—Tacoda-Wakeley complex, 0 to 4 percent slopes .....	80	215B—Typic Udipsamments, loamy substratum, nearly level and undulating .....	107
97—Colonville very fine sandy loam, occasionally flooded .....	82	216B—Typic Udipsamments, loamy calcareous substratum, nearly level and undulating .....	108
100D—Curtisville sandy loam, 12 to 18 percent slopes .....	83	220B—Typic Udipsamments, nearly level and undulating .....	108
100E—Curtisville sandy loam, 18 to 25 percent slopes .....	84	220D—Typic Udipsamments, hilly .....	109
103B—Nester sandy loam, 1 to 6 percent slopes .....	85	220E—Typic Udipsamments, steep .....	110
103C—Nester sandy loam, 6 to 12 percent slopes .....	86	221B—Typic Udipsamments, banded substratum, nearly level and undulating .....	111
108B—Selkirk loam, 0 to 4 percent slopes .....	87	221C—Typic Udipsamments, banded substratum, rolling .....	111
114A—Ingalls sand, 0 to 3 percent slopes .....	89	221D—Typic Udipsamments, banded substratum, hilly .....	112
120B—Morganlake sand, 0 to 6 percent slopes .....	90	221E—Typic Udipsamments, banded substratum, steep .....	113
120C—Morganlake sand, 6 to 12 percent slopes .....	91	222B—Typic Udipsamments, very deep water table, nearly level and undulating .....	114
123D—Klacking sand, 6 to 18 percent slopes .....	93	223B—Graycalm-Grayling sands, nearly level and undulating .....	115
124—Evert sand .....	93	223C—Graycalm-Grayling sands, rolling .....	115
127—Cathro muck .....	94	223D—Graycalm-Grayling sands, hilly .....	116
128—Dawson peat .....	95	223E—Graycalm-Grayling sands, steep .....	117
130—Grousehaven muck .....	96	224B—Crowell sand, nearly level and undulating .....	118
159A—Finch sand, 0 to 3 percent slopes .....	97	225B—Entic Haplorthods, sandy, loamy substratum, nearly level and undulating .....	119
182—Pits, quarry .....	98	225C—Entic Haplorthods, sandy, loamy substratum, rolling .....	120
197A—Gladwin loamy sand, 0 to 3 percent slopes .....	98	231D—Entic Haplorthods, sandy, banded substratum-Alfic Haplorthods, sandy, complex, hilly .....	120
209B—Grayling sand, calcareous substratum, nearly level and undulating .....	99	231E—Entic Haplorthods, sandy, banded substratum-Alfic Haplorthods, sandy, complex, steep .....	121
209C—Grayling sand, calcareous substratum, rolling .....	100		
209D—Grayling sand, calcareous substratum, hilly .....	100		
210B—Grayling sand, nearly level and undulating .....	101		
210C—Grayling sand, rolling .....	102		
210D—Grayling sand, hilly .....	102		

232B—Entic Haplorthods, sandy-Alfic Haplorthods, sandy, complex, very deep water table, nearly level and undulating .....	123	357B—Udipsamments-Urban land complex, 0 to 8 percent slopes .....	144
233B—Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine-loamy banded substratum, complex, nearly level and undulating .....	124	360—Wakeley muck .....	145
233C—Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine-loamy banded substratum, complex, rolling .....	125	367A—Whittemore-Springport complex, 0 to 3 percent slopes .....	146
233D—Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine-loamy banded substratum, complex, hilly .....	126	368A—Au Gres-Deford complex, 0 to 3 percent slopes .....	148
235B—Alfic Haplorthods, sandy over loamy- Alfic Haplorthods, sandy, complex, nearly level and undulating .....	127	369—Deford muck .....	150
235C—Alfic Haplorthods, sandy over loamy- Alfic Haplorthods, sandy, complex, rolling .....	128	370A—Mclvor sand, 0 to 3 percent slopes .....	151
236B—Arenic Eutroboralfs, loamy, nearly level and undulating .....	129	371—Springport silt loam .....	152
237B—Eutroboralfs, nearly level and undulating .....	129	372B—Proper-Leafriver complex, 0 to 6 percent slopes .....	153
237D—Eutroboralfs, hilly .....	130	375—Kanotin muck .....	154
254A—Borosaprists, euic-Fluvaquents- Aquic Udipsamments complex, nearly level .....	131	377—Wabun mucky sand .....	155
262A—Au Gres sand, nearly level .....	132	378A—Algonquin clay, 0 to 3 percent slopes .....	156
263A—Argic Endoaquods, nearly level .....	133	379A—Algonquin-Springport complex, 0 to 3 percent slopes .....	157
264A—Allendale loamy sand, nearly level .....	134	380—Access denied .....	159
265B—Eutroboralfs-Allendale complex, nearly level and undulating .....	134	381A—Mclvor-Wakeley complex, 0 to 3 percent slopes .....	159
266A—Typic Duraquods, sandy, nearly level ....	136	382B—Proper sand, 0 to 6 percent slopes .....	160
272—Endoaquods-Fluvaquents complex .....	136	383B—Wurtsmith sand, 0 to 6 percent slopes .....	161
273—Leafriver-Wakeley complex .....	137	392—Caffey mucky sand .....	162
274—Typic Endoaquods .....	138	403B—largo silt loam, 2 to 6 percent slopes ....	163
280—Aquepts and Histosols, ponded .....	139	403C—largo silt loam, 6 to 12 percent slopes .....	165
281—Borosaprists, dysic .....	140	404A—Manary silty clay loam, 0 to 3 percent slopes .....	166
282—Borosaprists, euic .....	140	405B—Manary-largo complex, 0 to 6 percent slopes .....	167
343—Sims loam, drained .....	141	406A—Winterfield loamy sand, rarely flooded, 0 to 2 percent slopes .....	169
355E—Crowell-Proper complex, 4 to 25 percent slopes .....	142	407—Lacota loam .....	170
356E—Aquepts-Histosols-Fluvaquents complex, nearly level to very steep .....	143	408—Sims loam .....	171
		409A—Finch-Deford-Au Gres complex, 0 to 3 percent slopes .....	172
		410B—Proper-Finch-Deford complex, 0 to 6 percent slopes .....	174
		411A—Meehan sand, 0 to 3 percent slopes ....	175
		425D—Hottis sandy loam, 12 to 18 percent slopes .....	176

426B—Coppler loamy sand, 0 to 6 percent slopes .....	177	446B—Wurtsmith-Meehan-Urban land complex, 0 to 6 percent slopes .....	209
426C—Coppler loamy sand, 6 to 12 percent slopes .....	178	447A—Whittemore sand, 0 to 3 percent slopes .....	210
427—Tonkey sandy loam .....	179	448A—Meehan-Tawas complex, 0 to 3 percent slopes .....	211
429D—Menominee sand, 12 to 18 percent slopes .....	179	449A—Kokosing sand, 0 to 3 percent slopes .....	213
430D—Mongo loam, 12 to 18 percent slopes .....	180	<b>Use and Management of the Soils</b> .....	215
430E—Mongo loam, 18 to 35 percent slopes .....	181	Crops and Pasture .....	215
431B—Skeel loamy sand, 0 to 6 percent slopes .....	182	Yields per Acre .....	217
432B—Wurtsmith-Meehan sands, 0 to 6 percent slopes .....	184	Land Capability Classification .....	217
433B—Morganlake-Graycalm sands, 0 to 6 percent slopes .....	185	Prime Farmland .....	218
434D—Graycalm-Menominee-Morganlake sands, 6 to 18 percent slopes .....	186	Woodland Management and Productivity .....	219
435B—Skeel-Algonquin-Aquepts complex, 0 to 6 percent slopes .....	188	Forest Cover Types .....	219
436A—Manary-Whittemore-Springport complex, 0 to 3 percent slopes .....	190	Woodland Products .....	219
437D—Wurtsmith-Meehan-Deer Park sands, 0 to 18 percent slopes .....	192	Plant Communities .....	224
438C—Meehan-Tawas-Wurtsmith complex, 0 to 12 percent slopes .....	193	Plant Associations .....	224
439D—Deer Park sand, 4 to 18 percent slopes .....	196	Windbreaks and Environmental Plantings .....	226
440B—Kawkawlin-Sims complex, 0 to 4 percent slopes .....	196	Recreation .....	227
441B—Morganlake-Nester complex, 0 to 6 percent slopes .....	199	Wildlife Habitat .....	227
441C—Morganlake-Nester complex, 6 to 12 percent slopes .....	200	Engineering .....	230
442D—Menominee-Curtisville complex, 12 to 18 percent slopes .....	202	Building Site Development .....	230
442E—Menominee-Curtisville complex, 18 to 35 percent slopes .....	204	Sanitary Facilities .....	231
443B—Kawkawlin-Allendale-Aquepts complex, 0 to 4 percent slopes .....	205	Construction Materials .....	232
444B—Kawkawlin sandy loam, 0 to 4 percent slopes .....	206	Water Management .....	233
445A—Corsair very fine sandy loam, 0 to 3 percent slopes .....	208	<b>Soil Properties</b> .....	235
		Engineering Index Properties .....	235
		Physical and Chemical Properties .....	236
		Soil and Water Features .....	237
		Soil Characterization Data for Selected Soils .....	239
		<b>Classification of the Soils</b> .....	241
		Soil Series and Their Morphology .....	241
		Alfic Haplorthods, Sandy .....	241
		Alfic Haplorthods, Sandy Over Loamy .....	242
		Algonquin Series .....	243
		Allendale Series .....	244
		Aquepts .....	244
		Aquepts .....	245
		Aquic Udipsamments .....	245
		Arenic Eutroboralfs .....	246
		Argic Endoaquods .....	247
		Au Gres Series .....	247
		Borosaprists .....	248
		Caffey Series .....	248

Cathro Series .....	249	Rollaway Series .....	279
Colonville Series .....	249	Rubicon Series .....	279
Coppler Series .....	250	Selkirk Series .....	280
Corsair Series .....	250	Sims Series .....	281
Croswell Series .....	251	Skeel Series .....	281
Crowell Series .....	251	Springport Series .....	282
Cublake Series .....	252	Sprinkler Series .....	283
Curtisville Series .....	253	Tacoda Series .....	283
Dawson Series .....	253	Tawas Series .....	284
Deer Park Series .....	254	Tonkey Series .....	284
Deford Series .....	254	Typic Duraquods .....	285
Dorval Series .....	255	Typic Endoaquods .....	286
East Lake Series .....	255	Typic Udipsamments .....	286
Endoaquods .....	256	Udipsamments .....	287
Entic Haplorthods .....	256	Udorthents .....	287
Eutroboralfs .....	257	Wabun Series .....	287
Ewart Series .....	258	Wakeley Series .....	288
Finch Series .....	258	Whittemore Series .....	288
Fluvaquents .....	259	Winterfield Series .....	289
Gladwin Series .....	259	Wurtsmith Series .....	290
Glennie Series .....	260	Zimmerman Series .....	290
Graycalm Series .....	261	<b>Formation of the Soils</b> .....	293
Grayling Series .....	261	Factors of Soil Formation .....	293
Grousehaven Series .....	262	Parent Material .....	293
Histosols .....	262	Climate .....	294
Hottis Series .....	263	Plant and Animal Life .....	294
Iargo Series .....	263	Relief .....	294
Ingalls Series .....	264	Time .....	294
Kanotin Series .....	265	Human Activities .....	295
Kawkawlin Series .....	265	Processes of Soil Formation .....	295
Kent Series .....	266	<b>References</b> .....	297
Klacking Series .....	266	<b>Glossary</b> .....	299
Kokosing Series .....	267	<b>Tables</b> .....	313
Lacota Series .....	268	Table 1.—Temperature and Precipitation .....	314
Leafriver Series .....	268	Table 2.—Freeze Dates in Spring and Fall .....	315
Lupton Series .....	269	Table 3.—Growing Season .....	315
Manary Series .....	269	Table 4.—Acreage and Proportionate Extent	
Mclvor Series .....	270	of the Soils .....	316
Meehan Series .....	270	Table 5.—Land Capability and Yields per	
Menominee Series .....	275	Acre of Crops .....	319
Mongo Series .....	276	Table 6.—Prime Farmland .....	326
Morganlake Series .....	276	Table 7.—Woodland Management and	
Negwegon Series .....	277	Productivity .....	327
Nester Series .....	278	Table 8.—Equipment Limitations on	
Proper Series .....	278	Woodland .....	356

---

Table 9.—Plant Communities on Selected Soils .....	372	Table 15.—Construction Materials .....	456
Table 10.—Windbreaks and Environmental Plantings .....	386	Table 16.—Water Management .....	471
Table 11.—Recreational Development .....	396	Table 17.—Engineering Index Properties .....	486
Table 12.—Wildlife Habitat .....	412	Table 18.—Physical and Chemical Properties of the Soils .....	515
Table 13.—Building Site Development .....	423	Table 19.—Water Features .....	530
Table 14.—Sanitary Facilities .....	439	Table 20.—Soil Features .....	539
		Table 21.—Classification of the Soils .....	548

Issued 2002

# Foreword

---

This soil survey contains information that affects land use planning in Iosco County. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

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

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations that affect various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

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

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

Ronald L. Williams  
State Conservationist  
Natural Resources Conservation Service



# Soil Survey of Iosco County, Michigan

---

By Erik P. Johnson, Michigan Department of Agriculture

Fieldwork by Richard W. Neilson and Jonathon D. Reedstrom, Natural Resources Conservation Service; Erik P. Johnson, Michigan Department of Agriculture; and Ramez A. Mahjoory, Bud Hart, and Joseph Gates, Forest Service

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with Michigan Department of Agriculture; Michigan Agricultural Experiment Station; Michigan Technological University; United States Department of Agriculture, Forest Service; and Iosco County Board of Commissioners

Iosco County is in the northeast quarter of the lower peninsula of Michigan (fig. 1). The county is bordered on the north by Alcona County, on the west by Ogemaw County, on the south by Arenac County, and on the east by Lake Huron. Iosco County covers an area of 361,837 acres, or about 565 square miles. About 64 percent of the county is forested, 11 percent is used for agriculture, and 25 percent is used for other purposes, including recreational facilities. The forested area includes 112,000 acres in the Huron National Forest. Tawas City, the county seat, has a population of 2,009. East Tawas has a population of 2,887.

Tourism is the main enterprise in the county. Timber production, agriculture, gypsum mining, and manufacturing also are important.

Soil scientists have determined that there are about 171 map units representing the various soils in Iosco County. The soils range widely in texture, natural drainage, slope, and other characteristics.

## General Nature of the County

This section provides general information about Iosco County. It describes history and development, climate, lakes and streams, farming, industry and transportation facilities, and physiography.

## History and Development

The original residents of Iosco County were Native Americans known as the Sauk Indians. These people were driven out of the area by a combination of the Chippewa, Ottawa, Menominee, and Algonquin tribes. The Ottawa and Algonquin tribes were still in the area when European settlers arrived.

The first European in the county was an Englishman named Henry who escaped the Mackinac massacre and was brought as a captive into the area in 1764 (Iosco County Historical Society). The first explorers were French fur traders. One of these was Louis Chevalier, who landed at the mouth of the Au Sable River some time before 1800 and was the first European resident in the survey area.

The State of Michigan created the county in 1857. The original county name was "Kahnnotin," which means "in the path of the big wind" and refers to a devastating storm. Native Americans avoided this area until Henry Schoolcraft renamed the county "Iosco," which means "water of light." The name Ottawas Bay was also shortened to Tawas Bay.

Au Sable was the first settlement in the county. It was established when two families settled in 1848. Tawas City was platted in 1855. A second town was



Figure 1.—Location of Iosco County in Michigan.

established in 1887 at a mill site that workers from Tawas City referred to as “Going East,” and thus it came to be called East Tawas.

In 1840, gypsum was discovered in outcroppings on the Lake Huron shoreline. Quarries were opened in 1862 in Alabaster Township. In 1891, the Western Plaster Works started business; in 1902, this company became the United States Gypsum Company. In 1926, National Gypsum was established.

Like most counties in northern Michigan, lumbering played a part in the development of Iosco County (fig. 2). Lumbering started in the mid 1860's and continued until about 1911, when large areas in northeastern Michigan burned, including Oscoda and Au Sable. The Lake Huron and Southwestern Railroad was built in 1877 to haul lumber and, later, farm products. In 1894, this railroad system became the Detroit and Mackinac Railroad.

In 1925, a runway was started for what was to become Camp Skeel, a harsh environment test facility. In 1942, this facility became the Oscoda Army Air Field. The base was closed for a few years after World War II but was reopened in 1948 as part of the Air Force's defense net. The base was renamed for Paul B. Wurtsmith in 1953. It was closed in 1992.

## Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Hale Loud Dam in the period 1961 to 1990. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 20.6 degrees F and the average daily minimum temperature is 11.2 degrees. The lowest temperature on record, which occurred on February 17, 1979, is -40 degrees. In summer, the average temperature is 65.9 degrees and the average daily maximum temperature is 78.3 degrees. The highest recorded temperature, which occurred on August 24, 1948, is 100 degrees.

Growing degree days are shown in table 1. They are equivalent to “heat units.” During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 28.07 inches. Of this, about 15.4 inches, or 55 percent, usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 3.24 inches on July 31, 1973. Thunderstorms occur on about 32 days each year, and most occur in June, July, and August.

The average seasonal snowfall is 50.2 inches. The greatest snow depth at any one time during the period of record was 46 inches. On the average, 112 days of the year have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 13.5 inches recorded on March 9, 1998.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 83 percent. The sun shines about 64 percent of the time possible in summer and 35 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 9 miles per hour, from November to April.

## Lakes and Streams

The county has about 12,000 acres of scattered lakes (fig. 3), reservoirs, and ponds. These water areas range from less than 5 acres to more than 1,900 acres in size. Some lakes are in marshes and exhibit all stages of filling by vegetation. Most of the lakes are



Figure 2.—The Lumbermen's Monument, "erected to perpetuate the memory of the pioneer lumbermen of Michigan through whose labors was made possible the development of the prairie states."



**Figure 3.—Increasing developmental pressure affects most of the lakes in Iosco County.**

in the northern half of the county. Among the larger ones are Cooke Pond, 1,942 acres; Foote Pond, 1,824 acres; Tawas Lake, 1,670 acres; Van Ettan Lake, 1,320 acres; Long Lake, 493 acres; Loon Lake, 417 acres;

and Sand Lake, 240 acres (Michigan United Conservation Clubs).

Iosco County has three major drainage systems—the Au Sable River, the Au Gres River, and the East

Branch of the Au Gres River. The Au Sable River drains the northern part of the county. It flows toward the east and enters the county in Plainfield Township. It empties into Lake Huron. The Au Gres River drains the southwestern part of the county. It enters the county in Reno Township and flows toward the southeast. It leaves the county in Sherman Township and empties into Saginaw Bay. The East Branch of the Au Gres River drains the west-central, central, and southern parts of the county. It leaves Loon Lake via Smith Creek, merges with Vaughan Creek in Grant Township, and flows toward the southeast. It leaves the county in Sherman Township and empties into Saginaw Bay.

## Farming

Farming in Iosco County began in the late 1800's, around the same time as the lumbering era. Farmsteads were established throughout the county, but it was quickly apparent that the soils in the central part of the county were too sandy to support crops. The farming soon concentrated in areas of the loamy soils.

The better cropland is in the southwestern part of the county, along M-55 and along M-65 to about Hale. Dairy farming and a few areas of cash crops are the main farming enterprises in the county. According to recent statistics, the county has about 26,800 acres of cropland; this represents about 11 percent of the total acreage, including a large portion used for pasture (Fedewa, 1993). Much of the marginal land has been set aside as wildlife habitat.

## Industry and Transportation Facilities

The major manufacturing operations in Iosco County are related to automobile products, aircraft repair, gypsum mining (fig. 4), and wood products.

There are two airports in the county. The local county airport is just northeast of East Tawas. The Oscoda-Wurtsmith airport in Oscoda, previously part of Wurtsmith Air Force Base, is used in the air industry. One railroad freight line serves the county. Three state highways run through the county.

## Physiography

Most of the topographic features of the county are a result of erosion or deposition during the Wisconsin Glaciation, the most recent glacial period. The part of the glacier that covered Michigan began to recede about 14,000 years ago and moved completely out about 8,000 years ago. The glacial drift that was left as

the ice melted covered the entire county to a depth ranging from 50 to several hundred feet. This drift formed such topographic features as moraines, till plains, outwash plains, lake plains, and glacial drainageways (Burgis and Eschman, 1981).

Figure 5 shows the glacial landforms in Iosco County. The western edge of the county is covered by the Hale Till Plain. This plain is nearly level to gently rolling and is dominantly loamy and clayey soils. A small moraine is along the county line around the Loon Lake area. This moraine has the most pronounced relief in the county. This area is also pocked with lakes, ponds, and small depressions. The dominant feature in the northern part of the county is the Jackpines Delta, which was formed as glacial meltwater deposited this sorted material via the glacial Au Sable drainageway. The delta has been eroded over thousands of years by the Au Sable River, which has cut down through this material a few hundred feet. This sandy, nearly level to rolling area is dominantly owned by the Huron National Forest. The meltwater was deposited in the glacial lakes that had many different levels across the county in the area known as the Oscoda Lake Plain. These glacial lakes had varying depths depending on the position of the glacier. The depth of water and the materials carried in the water influenced what was left behind when the glacial lakes dried up. Much of the meltwater from the Au Sable drainageway contained sand. This sand was deposited over some areas of clayey materials. The Oscoda Lake Plain is a nearly level to undulating area and contains fine textured soils; it also contains, in the southern part, soils that have a thin sandy cap over clays and silts. Closer to the edge of the delta, the soils are more sandy. Much of the Lake Huron shoreline has been shaped and reshaped by shore erosion caused by wave action. Sand is deposited into Lake Huron and is moved along the shoreline, forming beach ridges. As the water level of Lake Huron dropped, a series of beach ridges was left as a ridge-and-swale complex. This shoreline erosion and deposition have formed and are still forming points and spits along the Iosco County shore. Tawas Point and Au Sable Point are examples.

Figure 6 is a cross-section of the county showing elevation and landforms. The elevation of Iosco County ranges from about 580 feet above sea level along the Lake Huron shore to about 1,030 feet above sea level in the northwest corner of the county.

## How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and



**Figure 4.—Gypsum mining includes this area in the southwestern part of the county. The mines are strip mines that remove as much as 50 feet of earth to get to the gypsum rock.**

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

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

kind of soil or miscellaneous area 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-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with

precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are

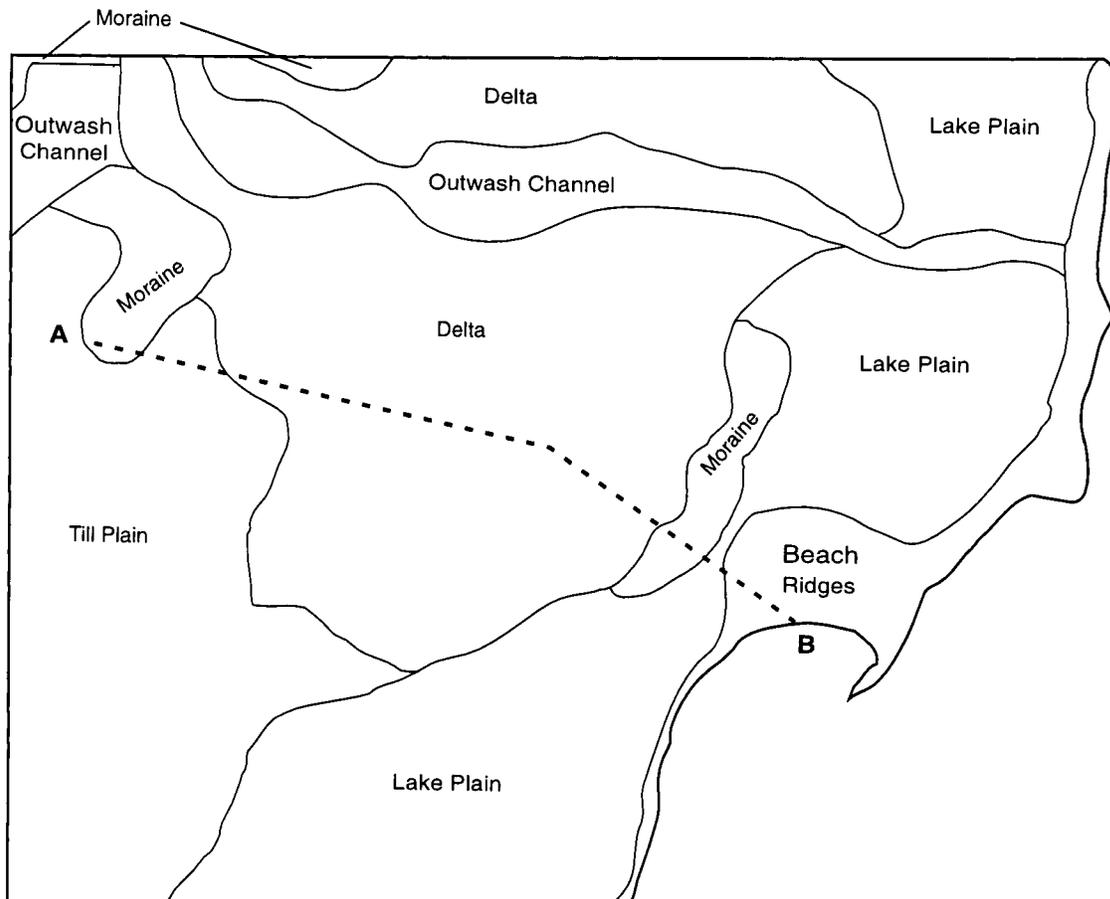


Figure 5.—The dominant glacial landforms in Iosco County (modified after Burgis and Eschman, 1981).

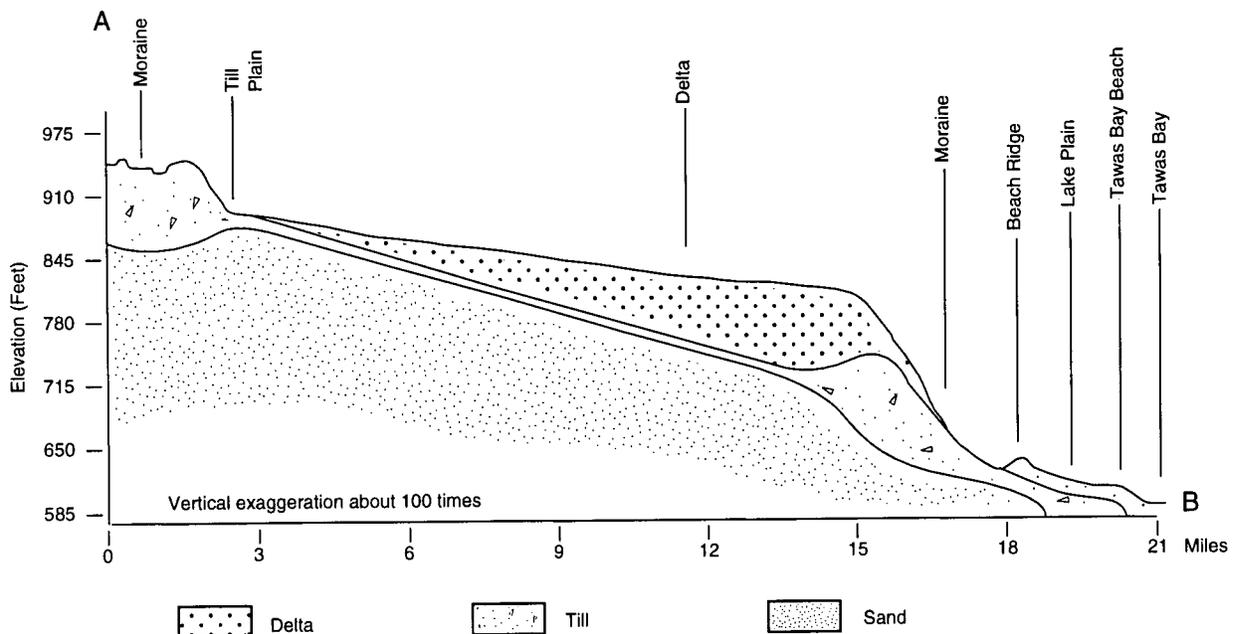


Figure 6.—A cross-section of Iosco County showing elevation and landforms (modified after Burgis and Eschman, 1981).

developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

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

Some of the soil boundaries on the soil maps of Iosco County do not match those on the maps of adjacent counties, and some of the soil names and descriptions do not fully agree. Differences are the result of improvements in the classification of soils, particularly modifications or refinements in soil series concepts.

## Survey Procedures

The general procedures followed in making this survey are described in the National Soil Survey Handbook of the Natural Resources Conservation Service. The Huron-Manistee National Forest ecological classification system (Cleland and others) was used in conjunction with the handbook to prepare the soil survey on most of the Forest Service lands and on some private tracts within the Huron National Forest administrative boundary. The map units on the Forest Service lands were designed differently from those in other parts of the survey area.

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

### Procedures for Map Units 1 to 199 and 300 to 449

The soil survey maps made for conservation planning prior to the start of the project are among the references used. Before the actual fieldwork was begun, preliminary boundaries of slopes and landforms were plotted stereoscopically on 1:15,840 leaf-off aerial photography. U.S. Geological Survey

topographic maps, at a scale of 1:24,000, were used to relate land and image features.

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

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

Observations of such items as landforms, blown-down trees, vegetation, and roadbanks were made without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, 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 pits that were dug with shovels, mattocks, and digging bars.

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

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

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

Several fairly large tracts of land in the survey area were not mapped. Landowners refused permission for soil scientists to map these areas. These areas are identified on the detailed soil maps by the symbol 380 (Access denied).

### **Procedures for Map Units 200 to 299**

Before ecological units were mapped, information about the climate, geology, soils, hydrology, and vegetation in the survey area was collected. Research techniques were used in mid and late successional

stands to collect information on vegetative and soil components in areas on uplands. Samples were not collected in early successional aspen stands, young stands, plantations, or stands disturbed by recent harvest or fires. The results were used to develop the ecological map units that are defined on the basis of both abiotic and biotic landscape characteristics.

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

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

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

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



# General Soil Map Units

---

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

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

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

The general soil map units in this survey have been grouped for broad interpretive purposes. Each of the broad groups and the map units in each group are described on the following pages.

## Soils on Wave-Built Terraces, Beach Ridges, and Dunes

These soils are generally used as woodland. The major management concerns are equipment limitations, seedling mortality, plant competition, and the windthrow hazard. Some areas, mostly along the Lake Huron shore, are used for building site development. The major soils are generally poorly suited or well suited to development. Wetness, ponding, slope, a poor filtering capacity, and a hazard of cutbanks caving are the major management concerns.

### 1. Au Gres-Tawas-Wurtsmith Association

*Nearly level and undulating, somewhat poorly drained, very poorly drained, and moderately well drained, sandy and mucky soils on wave-built terraces and beach ridges*

#### **Setting**

*Landform:* Beach ridges and wave-built terraces  
*Slope range:* 0 to 6 percent

#### **Composition**

*Percent of the survey area:* Less than 1  
*Extent of the soils in the association:*  
Au Gres soils—40 percent  
Tawas and similar soils—24 percent  
Wurtsmith and similar soils—14 percent  
Soils of minor extent—22 percent

#### **Soil Properties and Qualities**

##### **Au Gres**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Low ridges  
*Parent material:* Sandy lake deposits  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level

##### **Tawas**

*Drainage class:* Very poorly drained  
*Position on the landform:* Depressions and swales  
*Parent material:* Herbaceous material over sandy lake deposits  
*Texture of the surface layer:* Muck  
*Slope class:* Nearly level

##### **Wurtsmith**

*Drainage class:* Moderately well drained  
*Position on the landform:* Ridges and broad flat areas

*Parent material:* Sandy lake deposits  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level and undulating

### **Minor Soils**

- The very poorly drained, sandy over clayey Wakeley soils in depressions
- The excessively drained East Lake soils in the higher positions

### **Use and Management**

*Major uses:* Woodland, building site development  
*Major management concerns:* Woodland—equipment limitations, seedling mortality, windthrow hazard, plant competition; building site development—wetness, hazard of cutbanks caving, poor filtering capacity, ponding, low strength

## **2. Deer Park-Meehan-Wurtsmith Association**

*Nearly level to rolling, excessively drained, somewhat poorly drained, and moderately well drained, sandy soils on wave-built terraces, beach ridges, and dunes*

### **Setting**

*Landform:* Wave-built terraces, beach ridges, and dunes (fig. 7)

*Slope range:* 0 to 18 percent

### **Composition**

*Percent of the survey area:* 5

*Extent of the soils in the association (fig. 8):*

Deer Park and similar soils—25 percent

Meehan and similar soils—24 percent



Figure 7.—Shoreline erosion causes the development of sand spits at Au Sable Point. In the background are old beach ridges and swales of the Deer Park-Meehan-Wurtsmith association.

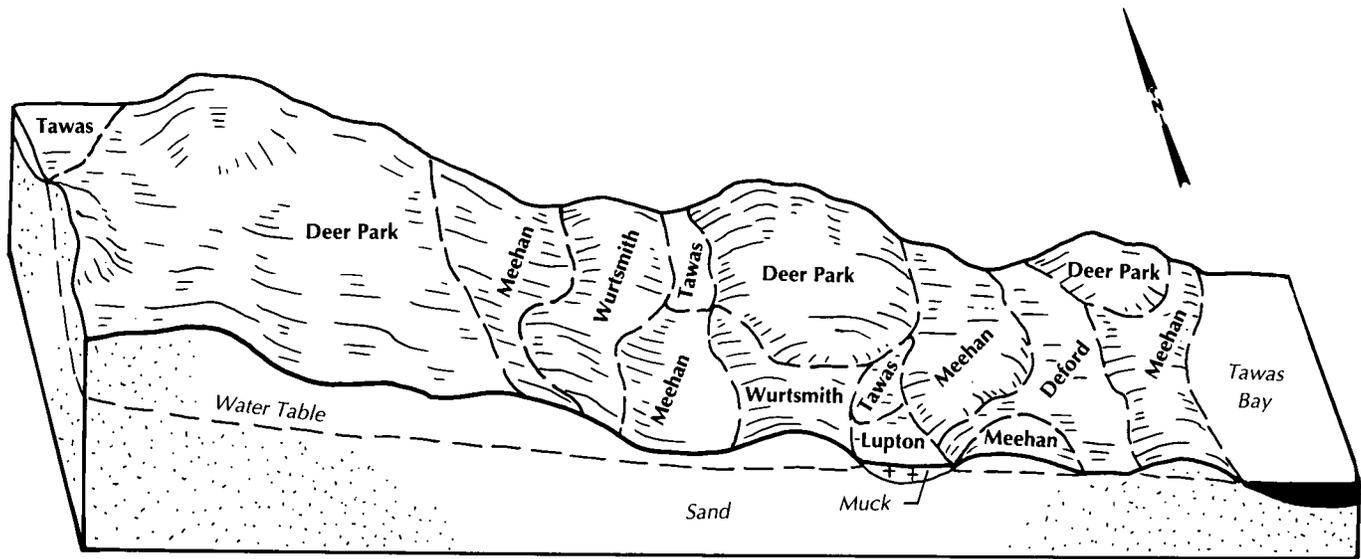


Figure 8.—Typical pattern of soils and landscape in the Deer Park-Meehan-Wurtsmith association.

Wurtsmith and similar soils—18 percent  
 Components of minor extent—33 percent

**Soil Properties and Qualities**

**Deer Park**

*Drainage class:* Excessively drained  
*Position on the landform:* High ridges and dunes  
*Parent material:* Sandy outwash, dune and beach deposits  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level to rolling

**Meehan**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Low ridges  
*Parent material:* Sandy outwash and beach deposits  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level

**Wurtsmith**

*Drainage class:* Moderately well drained  
*Position on the landform:* Ridges and broad flats  
*Parent material:* Sandy outwash and beach deposits  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level and undulating

**Minor Components**

- The very poorly drained Tawas and Deford soils in depressions and swales and along drainageways
- Areas of Urban land near Oscoda and Tawas
- The somewhat poorly drained Winterfield soils along the Au Sable and Dead Au Sable Rivers

**Use and Management**

*Major uses:* Woodland, building site development  
*Major management concerns:* Woodland—equipment limitations, seedling mortality, windthrow hazard, plant competition; building site development—hazard of cutbanks caving, poor filtering capacity, wetness, water erosion

**3. Finch-Deford-Proper Association**

*Nearly level and undulating, somewhat poorly drained, very poorly drained, and moderately well drained, sandy and mucky soils on wave-built terraces*

**Setting**

*Landform:* Wave-built terraces  
*Slope range:* 0 to 6 percent

**Composition**

*Percent of the survey area:* 5  
*Extent of the soils in the association:*  
 Finch and similar soils—35 percent  
 Deford soils—30 percent  
 Proper soils—10 percent  
 Soils of minor extent—25 percent

**Soil Properties and Qualities**

**Finch**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Broad flats  
*Parent material:* Sandy lake sediments

*Texture of the surface layer:* Sand  
*Slope class:* Nearly level

#### **Deford**

*Drainage class:* Very poorly drained  
*Position on the landform:* Low flats and depressions  
*Parent material:* Sandy lake sediments  
*Texture of the surface layer:* Muck  
*Slope class:* Nearly level

#### **Proper**

*Drainage class:* Moderately well drained  
*Position on the landform:* Beach ridges and dunes  
*Parent material:* Sandy lake deposits  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level and undulating

#### **Minor Soils**

- The very poorly drained Kanotin soils on broad flats and in depressions
- The very poorly drained Tawas and Lupton soils in depressions

#### **Use and Management**

*Major uses:* Woodland  
*Major management concerns:* Equipment limitations, windthrow hazard, seedling mortality, plant competition

### **4. Deford-Tawas-Lupton Association**

*Nearly level, very poorly drained, sandy and mucky soils on wave-built terraces*

#### **Setting**

*Landform:* Wave-built terraces  
*Slope range:* 0 to 2 percent

#### **Composition**

*Percent of the survey area:* 6  
*Extent of the soils in the association:*  
 Deford and similar soils—37 percent  
 Tawas and similar soils—21 percent  
 Lupton and similar soils—20 percent  
 Soils of minor extent—22 percent

#### **Soil Properties and Qualities**

#### **Deford**

*Drainage class:* Very poorly drained  
*Position on the landform:* Low flats and depressions  
*Parent material:* Sandy lake sediments  
*Texture of the surface layer:* Muck  
*Slope class:* Nearly level

#### **Tawas**

*Drainage class:* Very poorly drained  
*Position on the landform:* Low flats and depressions  
*Parent material:* Herbaceous muck over sandy lake sediments  
*Texture of the surface layer:* Muck  
*Slope class:* Nearly level

#### **Lupton**

*Drainage class:* Very poorly drained  
*Position on the landform:* Low flats and depressions  
*Parent material:* Herbaceous muck  
*Texture of the surface layer:* Muck  
*Slope class:* Nearly level

#### **Minor Soils**

- The somewhat poorly drained Winterfield soils in recent deposits along rivers
- The somewhat poorly drained Au Gres soils on low ridges
- The poorly drained Lacota soils on broad flats

#### **Use and Management**

*Major uses:* Woodland  
*Major management concerns:* Equipment limitations, windthrow hazard, seedling mortality, plant competition

### **Soils on Outwash Plains, Stream Terraces, and Deltas**

These soils are generally used as woodland. The major concerns in managing woodland are the windthrow hazard, plant competition, seedling mortality, the hazard of erosion, and equipment limitations. The major soils are generally unsuited to use as cropland and are unsuited or poorly suited to pasture. Droughtiness, wetness, and nutrient and pesticide loss are the major management concerns.

### **5. Borosaprists-Typic Udipsamments-Croswell Association**

*Nearly level to steep, very poorly drained, excessively drained, and moderately well drained, organic and sandy soils on stream terraces*

#### **Setting**

*Landform:* Stream terraces  
*Slope range:* 0 to 35 percent

#### **Composition**

*Percent of the survey area:* 5

*Extent of the soils in the association:*

- Borosapristis—45 percent
- Typic Udipsamments and similar soils—20 percent
- Croswell soils—10 percent
- Soils of minor extent—25 percent

### **Soil Properties and Qualities**

#### **Borosapristis**

*Drainage class:* Very poorly drained  
*Position on the landform:* Backswamps and along drainageways  
*Parent material:* Herbaceous muck  
*Texture of the surface layer:* Muck  
*Slope class:* Nearly level

#### **Typic Udipsamments**

*Drainage class:* Excessively drained  
*Position on the landform:* Side slopes  
*Parent material:* Sandy outwash  
*Texture of the surface layer:* Sand  
*Slope class:* Rolling to steep

#### **Croswell**

*Drainage class:* Moderately well drained  
*Position on the landform:* Ridges and knolls  
*Parent material:* Sandy outwash  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level and undulating

### **Minor Soils**

- The somewhat poorly drained Au Gres soils on low ridges and knolls
- The very poorly drained Deford soils in depressions and along drainageways
- The well drained Coppler soils and Argic Endoaquods on terraces along the Au Sable River

### **Use and Management**

*Major uses:* Woodland  
*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition, water erosion

## **6. Grayling Association**

*Nearly level to rolling, excessively drained, sandy soils on outwash plains and deltas*

### **Setting**

*Landform:* Outwash plains and deltas  
*Slope range:* 0 to 18 percent

### **Composition**

*Percent of the survey area:* 37

*Extent of the soils in the association:*

- Grayling and similar soils—76 percent
- Soils of minor extent—24 percent

### **Soil Properties and Qualities**

#### **Grayling**

*Drainage class:* Excessively drained  
*Position on the landform:* Broad plains  
*Parent material:* Sandy outwash  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level to rolling

### **Minor Soils**

- The moderately well drained Croswell soils in the lower positions
- The very poorly drained Tawas and Lupton soils in depressions and along drainageways

### **Use and Management**

*Major uses:* Woodland  
*Major management concerns:* Equipment limitations, seedling mortality

## **7. Au Gres-Croswell-Rubicon Association**

*Nearly level to rolling, somewhat poorly drained, moderately well drained, and excessively drained, sandy soils on outwash plains and deltas*

### **Setting**

*Landform:* Outwash plains and deltas  
*Slope range:* 0 to 18 percent

### **Composition**

*Percent of the survey area:* 11  
*Extent of the soils in the association:*  
 Au Gres soils—30 percent  
 Croswell soils—27 percent  
 Rubicon soils—11 percent  
 Soils of minor extent—32 percent

### **Soil Properties and Qualities**

#### **Au Gres**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Low flats  
*Parent material:* Sandy outwash  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level

#### **Croswell**

*Drainage class:* Moderately well drained  
*Position on the landform:* Broad flats

*Parent material:* Sandy outwash  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level and undulating

### **Rubicon**

*Drainage class:* Excessively drained  
*Position on the landform:* Knolls and ridges  
*Parent material:* Sandy outwash  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level to rolling

### **Minor Soils**

- The somewhat poorly drained, sandy over clayey Allendale soils on low knolls and low ridges
- The very poorly drained Deford and Tawas soils in depressions and along drainageways

### **Use and Management**

*Major uses:* Woodland  
*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition

## **Soils on Lake Plains**

These soils are used as cropland, pasture, or woodland or as gypsum mines. They are well suited or moderately well suited to use as cropland or pasture. The major management concerns affecting cropland are water erosion, compaction, slow permeability, nutrient and pesticide loss, soil blowing, wetness, and tilth of the surface layer. Wetness, compaction, overgrazing, and droughtiness are the main concerns affecting pasture management. Equipment limitations, the hazard of erosion, seedling mortality, the windthrow hazard, and plant competition are the main management concerns in the areas of woodland.

Onsite investigation is needed to determine the suitability of these soils for specific uses in or around gypsum mines.

## **8. Manary-Whittemore-largo Association**

*Nearly level to gently rolling, somewhat poorly drained and moderately well drained, sandy and loamy soils*

### **Setting**

*Landform:* Lake plains  
*Slope range:* 0 to 12 percent

### **Composition**

*Percent of the survey area:* 5  
*Extent of the soils in the association (fig. 9):*  
 Manary and similar soils—27 percent

Whittemore and similar soils—21 percent  
 largo and similar soils—20 percent  
 Soils of minor extent—32 percent

### **Soil Properties and Qualities**

#### **Manary**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Broad plains and low knolls  
*Parent material:* Fine textured lacustrine deposits  
*Texture of the surface layer:* Silty clay loam  
*Slope class:* Nearly level

#### **Whittemore**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Low ridges  
*Parent material:* Sandy over clayey lacustrine deposits  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level

#### **largo**

*Drainage class:* Moderately well drained  
*Position on the landform:* Knolls and ridges  
*Parent material:* Fine textured lacustrine deposits  
*Texture of the surface layer:* Silt loam  
*Slope class:* Nearly level to gently rolling

### **Minor Soils**

- The poorly drained Springport soils in depressions and along drainageways
- The moderately well drained Skeel soils on ridges
- The well drained Mongo soils on steep side slopes

### **Use and Management**

*Major uses:* Cropland and pasture  
*Major management concerns:* Cropland—wetness, slow permeability, compaction, tilth, soil blowing, nutrient and pesticide loss, water erosion; pasture—wetness, compaction

## **9. Algonquin-Allendale-Springport Association**

*Nearly level, somewhat poorly drained and poorly drained, clayey, sandy, and loamy soils*

### **Setting**

*Landform:* Lake plains  
*Slope range:* 0 to 3 percent

### **Composition**

*Percent of the survey area:* 2  
*Extent of the soils in the association:*  
 Algonquin and similar soils—33 percent  
 Allendale and similar soils—31 percent

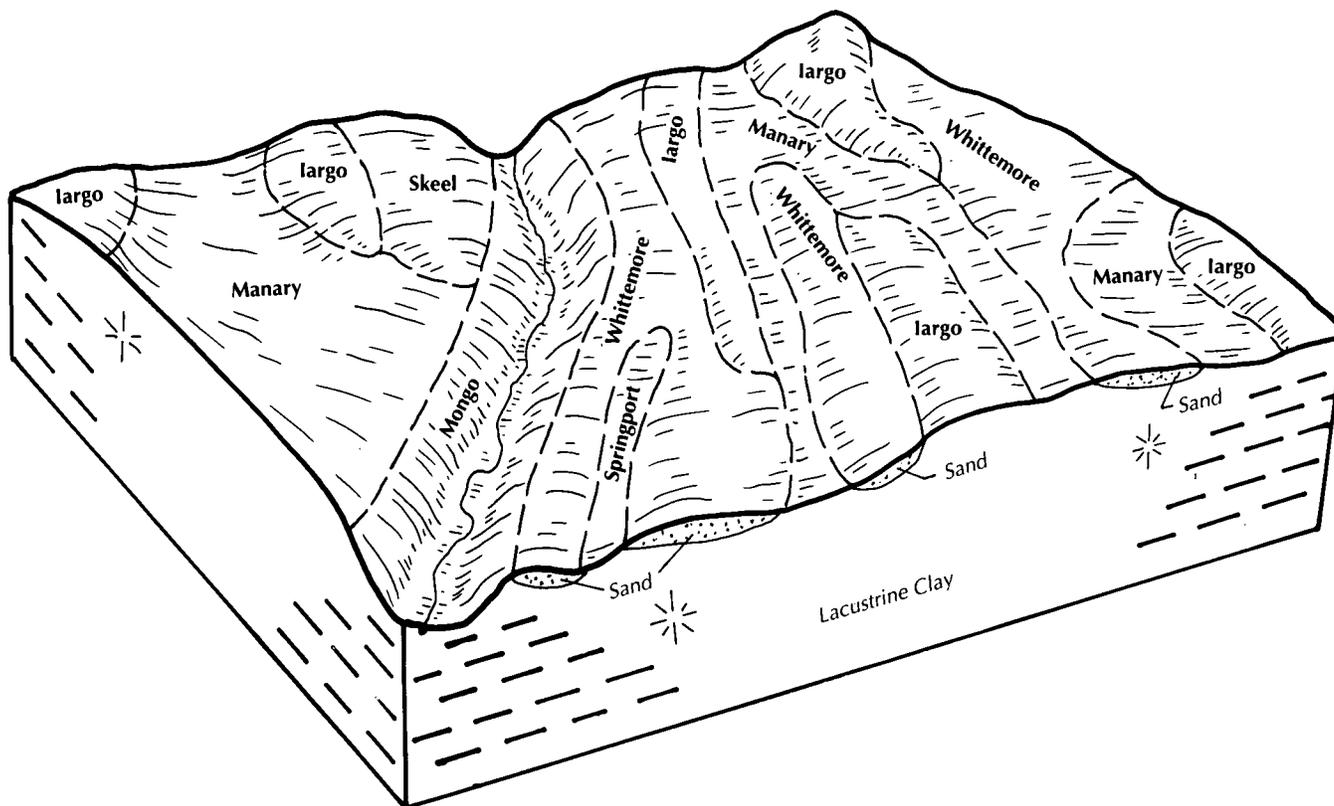


Figure 9.—Typical pattern of soils and landscape in the Manary-Whitemore-largo association.

Springport and similar soils—16 percent  
 Soils of minor extent—20 percent

**Soil Properties and Qualities**

**Algonquin**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Low ridges and broad plains  
*Parent material:* Fine textured lacustrine deposits  
*Texture of the surface layer:* Clay  
*Slope class:* Nearly level

**Allendale**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Low ridges  
*Parent material:* Sandy over clayey lacustrine deposits  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level

**Springport**

*Drainage class:* Poorly drained  
*Position on the landform:* Depressions and along drainage ways  
*Parent material:* Fine textured lacustrine deposits  
*Texture of the surface layer:* Silt loam

*Slope class:* Nearly level

**Minor Soils**

- The very poorly drained, sandy over clayey Wakeley soils in depressions and along drainageways
- The moderately well drained Negwegon soils on side slopes

**Use and Management**

*Major uses:* Cropland and pasture  
*Major management concerns:* Cropland—wetness, slow permeability, tith, compaction, soil blowing, low content of organic matter, nutrient and pesticide loss, ponding; pasture—wetness, compaction, overgrazing

**10. McIvor-Wakeley Association**

*Nearly level, somewhat poorly drained and very poorly drained, sandy and mucky soils*

**Setting**

*Landform:* Lake plains  
*Slope range:* 0 to 3 percent

### **Composition**

*Percent of the survey area:* 4  
*Extent of the soils in the association:*  
 Mclvor and similar soils—45 percent  
 Wakeley and similar soils—25 percent  
 Soils of minor extent—30 percent

### **Soil Properties and Qualities**

#### **Mclvor**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Low knolls and broad flats  
*Parent material:* Sandy over clayey lacustrine deposits  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level

#### **Wakeley**

*Drainage class:* Very poorly drained  
*Position on the landform:* Depressions and along drainageways  
*Parent material:* Sandy over clayey lacustrine deposits  
*Texture of the surface layer:* Muck  
*Slope class:* Nearly level

### **Minor Soils**

- The very poorly drained Kanotin and Tawas soils in depressions
- The moderately well drained Proper soils on low ridges

### **Use and Management**

*Major uses:* Woodland and pasture  
*Major management concerns:* Woodland—equipment limitations, windthrow hazard, seedling mortality, plant competition; pasture—wetness, overgrazing, droughtiness

## **11. Udorthents Association**

*Nearly level to very steep, loamy mine spoil and gypsum mines*

### **Setting**

*Landform:* Lake plains  
*Slope range:* 0 to 50 percent

### **Composition**

*Percent of the survey area:* 1  
*Extent of the soils in the association:*  
 Udorthents and similar soils—80 percent  
 Soils of minor extent—20 percent

### **Soil Properties and Qualities**

#### **Udorthents**

*Drainage class:* Well drained  
*Position on the landform:* Manmade ridges and pits  
*Parent material:* Fine textured lacustrine deposits  
*Texture of the surface layer:* Silty clay loam  
*Slope class:* Nearly level to very steep

### **Minor Soils**

- The somewhat poorly drained, loamy Algonquin and Manary soils in nearly level undisturbed areas
- The somewhat poorly drained, sandy over loamy Allendale soils in nearly level undisturbed areas

### **Use and Management**

*Major uses:* Gypsum mines and mine spoil  
*Major management concerns:* Onsite investigation is needed to determine the suitability for specific uses.

## **Soils on Till Plains and Moraines**

These soils are used as cropland, pasture, or woodland. They are the primary agricultural soils in the county. They are well suited or moderately well suited to use as cropland or pasture. The major management concerns affecting crops and pasture are water erosion, soil blowing, compaction, slow permeability, nutrient and pesticide loss, droughtiness, wetness, and tilth. Equipment limitations, seedling mortality, the windthrow hazard, and plant competition are the main management concerns in the areas of woodland. Wetness, the shrink-swell potential, a hazard of cutbanks caving, and frost action are the main management concerns affecting building site development.

## **12. Selkirk-Kent Association**

*Nearly level to gently rolling, somewhat poorly drained and moderately well drained, loamy soils on till plains*

### **Setting**

*Landform:* Till plains  
*Slope range:* 0 to 12 percent

### **Composition**

*Percent of the survey area:* 1  
*Extent of the soils in the association:*  
 Selkirk and similar soils—52 percent  
 Kent and similar soils—30 percent  
 Soils of minor extent—18 percent

### **Soil Properties and Qualities**

#### **Selkirk**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Flat areas and low knolls  
*Parent material:* Fine textured till  
*Texture of the surface layer:* Loam  
*Slope class:* Nearly level and undulating

#### **Kent**

*Drainage class:* Moderately well drained  
*Position on the landform:* Knolls and ridges  
*Parent material:* Fine textured till  
*Texture of the surface layer:* Sandy loam  
*Slope class:* Undulating and gently rolling

#### **Minor Soils**

- The moderately well drained, sandy over loamy Morganlake soils on knolls and ridges
- The somewhat poorly drained, sandy over loamy Allendale soils in flat areas and on low knolls
- The poorly drained Sims soils in depressions and along drainageways

#### **Use and Management**

*Major uses:* Cropland and pasture  
*Major management concerns:* Cropland—tilth, slow permeability, nutrient and pesticide loss, water erosion, wetness, compaction; pasture—wetness, compaction

### **13. Kawkawlin-Nester Association**

*Nearly level to gently rolling, somewhat poorly drained and moderately well drained, loamy soils on till plains*

#### **Setting**

*Landform:* Till plains  
*Slope range:* 0 to 12 percent

#### **Composition**

*Percent of the survey area:* 8  
*Extent of the soils in the association:*  
 Kawkawlin and similar soils—40 percent  
 Nester and similar soils—28 percent  
 Soils of minor extent—32 percent

### **Soil Properties and Qualities**

#### **Kawkawlin**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Low knolls and broad plains  
*Parent material:* Fine textured till

*Texture of the surface layer:* Loam  
*Slope class:* Nearly level and undulating

#### **Nester**

*Drainage class:* Moderately well drained  
*Position on the landform:* Knolls and ridges  
*Parent material:* Fine textured till  
*Texture of the surface layer:* Sandy loam  
*Slope class:* Undulating and gently rolling

#### **Minor Soils**

- The moderately well drained, sandy over loamy Morganlake soils on knolls and ridges
- The poorly drained Sims soils in depressions and along drainageways
- The somewhat poorly drained, sandy over loamy Kokosing soils on low knolls

#### **Use and Management**

*Major uses:* Cropland and pasture  
*Major management concerns:* Cropland—water erosion, tilth, slow permeability, nutrient and pesticide loss, compaction, wetness, soil blowing; pasture—compaction, wetness, overgrazing

### **14. Morganlake-Nester Association**

*Nearly level to gently rolling, moderately well drained, sandy and loamy soils on till plains and moraines*

#### **Setting**

*Landform:* Till plains and moraines  
*Slope range:* 0 to 12 percent

#### **Composition**

*Percent of the survey area:* 4  
*Extent of the soils in the association:*  
 Morganlake and similar soils—53 percent  
 Nester and similar soils—30 percent  
 Soils of minor extent—17 percent

### **Soil Properties and Qualities**

#### **Morganlake**

*Drainage class:* Moderately well drained  
*Position on the landform:* Knolls and ridges  
*Parent material:* Sandy over loamy till  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level to gently rolling

#### **Nester**

*Drainage class:* Moderately well drained  
*Position on the landform:* Knolls and ridges

*Parent material:* Fine textured till  
*Texture of the surface layer:* Sandy loam  
*Slope class:* Undulating and gently rolling

### **Minor Soils**

- The somewhat poorly drained Kokosing soils on low knolls and low ridges
- The excessively drained, sandy Rubicon soils on the higher knolls and ridges
- The very poorly drained Tawas and Lupton soils in depressions and along drainageways

### **Use and Management**

*Major uses:* Woodland, building site development  
*Major management concerns:* Woodland—equipment limitations, plant competition, seedling mortality; building site development—shrink-swell potential, frost action, hazard of cutbanks caving, wetness

## **15. Glennie-Sprinkler Association**

*Nearly level to gently rolling, moderately well drained and somewhat poorly drained, loamy soils on ground moraines*

### **Setting**

*Landform:* Moraines  
*Slope range:* 0 to 12 percent

### **Composition**

*Percent of the survey area:* Less than 1  
*Extent of the soils in the association:*  
 Glennie and similar soils—75 percent  
 Sprinkler soils—15 percent  
 Soils of minor extent—10 percent

### **Soil Properties and Qualities**

#### **Glennie**

*Drainage class:* Moderately well drained  
*Position on the landform:* Knolls and ridges  
*Parent material:* Loamy till  
*Texture of the surface layer:* Loamy sand  
*Slope class:* Nearly level to gently rolling

#### **Sprinkler**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Broad plains  
*Parent material:* Loamy till  
*Texture of the surface layer:* Sandy loam  
*Slope class:* Nearly level

### **Minor Soils**

- The very poorly drained Wakeley soils along drainageways

### **Use and Management**

*Major uses:* Cropland and woodland  
*Major management concerns:* Cropland—wetness, soil blowing, nutrient and pesticide loss, droughtiness; woodland—equipment limitations, windthrow hazard, plant competition, seedling mortality

## **16. Kawkawlin-Allendale-Nester Association**

*Nearly level to gently rolling, somewhat poorly drained and moderately well drained, loamy and sandy soils on till plains and moraines*

### **Setting**

*Landform:* Till plains and moraines  
*Slope range:* 0 to 12 percent

### **Composition**

*Percent of the survey area:* 2  
*Extent of the soils in the association:*  
 Kawkawlin and similar soils—35 percent  
 Allendale and similar soils—22 percent  
 Nester and similar soils—15 percent  
 Soils of minor extent—28 percent

### **Soil Properties and Qualities**

#### **Kawkawlin**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Low knolls and broad plains  
*Parent material:* Fine textured till  
*Texture of the surface layer:* Sandy loam  
*Slope class:* Nearly level and undulating

#### **Allendale**

*Drainage class:* Somewhat poorly drained  
*Position on the landform:* Low knolls  
*Parent material:* Sandy over clayey till  
*Texture of the surface layer:* Sand  
*Slope class:* Nearly level

#### **Nester**

*Drainage class:* Moderately well drained  
*Position on the landform:* Knolls and ridges  
*Parent material:* Fine textured till  
*Texture of the surface layer:* Sandy loam

*Slope class:* Undulating and gently rolling

### **Minor Soils**

- The very poorly drained, ponded Aquepts and the very poorly drained Wakeley soils along drainageways and in depressions
- The somewhat poorly drained Au Gres soils on low knolls
- The moderately well drained, sandy over loamy Morganlake soils on knolls

### **Use and Management**

*Major uses:* Woodland and cropland

*Major management concerns:* Woodland—equipment limitations, plant competition, windthrow hazard, seedling mortality; cropland—slow permeability, nutrient and pesticide loss, tith, water erosion, soil blowing, low content of organic matter

## **17. Kawkawlin-Sims Association**

*Nearly level and undulating, somewhat poorly drained and poorly drained, loamy soils on till plains*

### **Setting**

*Landform:* Till plains

*Slope range:* 0 to 4 percent

### **Composition**

*Percent of the survey area:* 3

*Extent of the soils in the association:*

Kawkawlin and similar soils—50 percent

Sims and similar soils—24 percent

Soils of minor extent—26 percent

### **Soil Properties and Qualities**

#### **Kawkawlin**

*Drainage class:* Somewhat poorly drained

*Position on the landform:* Low knolls and broad plains

*Parent material:* Fine textured till

*Texture of the surface layer:* Sandy loam

*Slope class:* Nearly level and undulating

#### **Sims**

*Drainage class:* Poorly drained

*Position on the landform:* Depressions and along drainageways

*Parent material:* Fine textured till

*Texture of the surface layer:* Loam

*Slope class:* Nearly level

### **Minor Soils**

- The moderately well drained Nester soils on knolls and ridges
- The somewhat poorly drained Kokosing soils on low ridges and low knolls
- The very poorly drained Tawas and Lupton soils in depressions

### **Use and Management**

*Major uses:* Woodland and cropland

*Major management concerns:* Woodland—equipment limitations, plant competition, windthrow hazard, seedling mortality; cropland—wetness, slow permeability, tith, compaction, ponding, nutrient and pesticide loss, water erosion



## Detailed Soil Map Units

---

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

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. 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 other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties 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, or similar, inclusions. They may or may not be mentioned in the map unit descriptions. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so

complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit 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, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

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

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

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Whittemore-Springport complex, 0 to 3 percent slopes, is an example.

An *undifferentiated group* is made up of two or

more soils or miscellaneous areas 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 or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Histosols and Aquents, ponded, is an undifferentiated group in this survey area.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The map unit Pits, borrow, is an example.

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

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

### Setting

*Landform:* Beach ridges

*Slope range:* Tawas—0 to 2 percent; Au Gres—0 to 4 percent

*Shape of areas:* Linear

*Size of areas:* 10 to 100 acres

### Typical Profile

#### Tawas

*Surface layer:*

0 to 12 inches—black muck

*Subsoil:*

12 to 24 inches—black, very friable muck

*Substratum:*

24 to 80 inches—light brownish gray sand

#### Au Gres

*Surface layer:*

0 to 3 inches—black, partially decomposed leaf litter

*Subsurface layer:*

3 to 9 inches—pinkish gray, mottled sand

*Subsoil:*

9 to 14 inches—dark reddish brown and dark brown, mottled, very friable sand

14 to 29 inches—yellowish brown, mottled, loose sand

*Substratum:*

29 to 80 inches—very pale brown sand

### Soil Properties and Qualities

*Permeability:* Tawas—moderately slow to moderately rapid in the mucky part and rapid in the sandy part; Au Gres—rapid

*Available water capacity:* Tawas—high; Au Gres—low

*Drainage class:* Tawas—very poorly drained; Au Gres—somewhat poorly drained

*Seasonal high water table:* Tawas—apparent, 1 foot above to 1 foot below the surface at some time from October through May; Au Gres—apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Tawas—ponded; Au Gres—very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Tawas—moderate; Au Gres—severe

*Shrink-swell potential:* Low

*Potential for frost action:* Tawas—high; Au Gres—moderate

### Composition

Tawas soil and similar soils: 60 to 70 percent

Au Gres soil and similar soils: 25 to 40 percent

Contrasting inclusions: 5 to 15 percent

### Inclusions

*Contrasting inclusions:*

- The very poorly drained Deford soils, which have organic material less than 8 inches thick
- The moderately well drained Wurtsmith soils

*Similar inclusions:*

- Soils that have organic layers more than 51 inches thick
- Soils that do not have a dark reddish brown subsoil

### Use and Management

*Land use:* Woodland

#### Woodland

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition, seedling mortality, seasonal wetness

*Management considerations:*

- Equipment should be used only when the soil is relatively dry or has an adequate snow cover.
- Carefully managed reforestation helps to control undesirable understory plants.

- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Trees that can withstand seasonal wetness should be selected for planting in areas of the Au Gres soil.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Tawas soil.

### Building sites

*Major management concerns:* Tawas—ponding; Au Gres—seasonal wetness, cutbanks caving

*Management considerations:*

- In areas of the Au Gres soil, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- In areas of the Au Gres soil, wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Because cutbanks in areas of the Au Gres soil are not stable and are subject to caving, trench walls should be reinforced.
- Because of ponding, the Tawas soil is generally unsuited to building site development.

### Septic tank absorption fields

*Major management concerns:* Tawas—ponding; Au Gres—rapid permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of the Au Gres soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table in areas of the Au Gres soil.
- Because of ponding, the Tawas soil is generally unsuited to septic tank absorption fields.

### Interpretive Groups

*Land capability classification:* Vlw

*Woodland ordination symbol:* Tawas—5W; Au Gres—6W

*Michigan soil management group:* Tawas—M/4c; Au Gres—5b

## 13—Tawas-Lupton mucks

### Setting

*Landform:* Outwash plains, lake plains, till plains, and moraines

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 500 acres

### Typical Profile

#### Tawas

*Surface layer:*

0 to 12 inches—black muck

*Subsoil:*

12 to 24 inches—black, friable muck

*Substratum:*

24 to 80 inches—light brownish gray sand

#### Lupton

*Surface layer:*

0 to 30 inches—black muck

*Substratum:*

30 to 80 inches—black and dark reddish brown muck

### Soil Properties and Qualities

*Permeability:* Tawas—moderately slow to moderately rapid in the mucky part and rapid in the sandy part; Lupton—moderately slow to moderately rapid

*Available water capacity:* Tawas—high; Lupton—very high

*Drainage class:* Very poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Tawas—low; Lupton—none

*Potential for frost action:* High

### Composition

Tawas soil and similar soils: 35 to 70 percent

Lupton soil and similar soils: 25 to 50 percent

Contrasting inclusions: 0 to 15 percent

### Inclusions

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils

- The very poorly drained Deford soils
- Small areas of open water

*Similar inclusions:*

- Soils that have thin layers of loamy material in the substratum
- Soils that have muck layers less than 16 inches thick
- Soils that are extremely acid

### **Use and Management**

*Land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Log landings should be located on drier, more suitable soils.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on these soils.
- Carefully managed reforestation helps to control undesirable understory plants.
- Selective cutting or cutting in strips and leaving desirable seed trees along the edge of the openings are beneficial for natural regeneration.

#### **Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, these soils are generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, these soils are generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* Vlw

*Woodland ordination symbol:* Tawas—5W; Lupton—2W

*Michigan soil management group:* Tawas—M/4c; Lupton—Mc

## **15A—Crowell-Au Gres sands, 0 to 3 percent slopes**

### **Setting**

*Landform:* Outwash plains and lake plains

*Slope range:* 0 to 3 percent

*Shape of areas:* Irregular or linear

*Size of areas:* 10 to 50 acres

### **Typical Profile**

#### **Crowell**

*Surface layer:*

0 to 4 inches—very dark gray sand

*Subsurface layer:*

4 to 7 inches—light gray sand

*Subsoil:*

7 to 11 inches—dark brown, very friable sand

11 to 36 inches—yellowish brown and brownish yellow, loose sand

*Substratum:*

36 to 60 inches—brownish yellow, mottled sand

60 to 80 inches—pale brown sand

#### **Au Gres**

*Surface layer:*

0 to 3 inches—black, partially decomposed leaf litter

*Subsurface layer:*

3 to 9 inches—pinkish gray, mottled sand

*Subsoil:*

9 to 14 inches—dark reddish brown and dark brown, mottled, very friable sand

14 to 29 inches—yellowish brown, mottled, loose sand

*Substratum:*

29 to 80 inches—very pale brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Crowell—moderately well drained; Au Gres—somewhat poorly drained

*Seasonal high water table:* Crowell—apparent, at a depth of 2.0 to 3.5 feet at some time from November through May; Au Gres—apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Croswell—low; Au Gres—moderate

### **Composition**

Croswell soil and similar soils: 35 to 70 percent

Au Gres soil and similar soils: 25 to 60 percent

Contrasting inclusions: 0 to 10 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Deford soils
- The excessively drained Grayling soils

*Similar inclusions:*

- Soils that have a surface layer of loamy sand
- Soils that do not have a dark reddish brown or dark brown subsoil

### **Use and Management**

*Land use:* Woodland

#### **Woodland**

*Major management concerns:* Croswell—equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal droughtiness; Au Gres—equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate on the Croswell soil.
- Trees that can withstand seasonal wetness should be selected for planting on the Au Gres soil.
- Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

#### **Building sites**

*Major management concerns:* Cutbanks caving, seasonal wetness

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Wetness can be reduced by installing a drainage

system around structures with basements and crawl spaces.

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

#### **Septic tank absorption fields**

*Major management concerns:* Rapid permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of these soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

### **Interpretive Groups**

*Land capability classification:* IVs

*Woodland ordination symbol:* Croswell—5S; Au Gres—6W

*Michigan soil management group:* Croswell—5a; Au Gres—5b

## **16B—Graycalm sand, 0 to 6 percent slopes**

### **Setting**

*Landform:* Outwash plains and stream terraces

*Shape of areas:* Irregular

*Size of areas:* 10 to 1,000 acres

### **Typical Profile**

*Surface layer:*

0 to 4 inches—black sand

*Subsoil:*

4 to 16 inches—strong brown, friable sand

16 to 45 inches—yellowish brown, brownish yellow, and yellow, very friable sand

*Substratum:*

45 to 80 inches—very pale brown sand with bands of strong brown loamy sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Somewhat excessively drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Very slow

*Flooding:* None  
*Hazard of water erosion:* Slight  
*Hazard of soil blowing:* Severe  
*Shrink-swell potential:* Low  
*Potential for frost action:* Low

### **Composition**

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

### **Inclusions**

*Contrasting inclusions:*

- The excessively drained Rubicon soils, which have reddish brown development in the subsoil

*Similar inclusions:*

- Soils that do not have bands of loamy sand in the substratum

### **Use and Management**

*Dominant land use:* Woodland  
*Other uses:* Pasture

#### **Pasture**

*Major management concerns:* Seasonal droughtiness, overgrazing

*Management considerations:*

- Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests can help to ensure the maximum growth of plants, especially legumes.

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

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

#### **Building sites**

*Major management concerns:* Cutbanks caving

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

#### **Septic tank absorption fields**

*Major management concerns:* Rapid permeability

*Management considerations:*

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

### **Interpretive Groups**

*Land capability classification:* IVs

*Woodland ordination symbol:* 6S

*Michigan soil management group:* 5a

## **16D—Graycalm sand, 12 to 18 percent slopes**

### **Setting**

*Landform:* Outwash plains and stream terraces

*Shape of areas:* Irregular

*Size of areas:* 10 to 60 acres

### **Typical Profile**

*Surface layer:*

0 to 1 inch—black sand

*Subsoil:*

1 to 4 inches—strong brown, very friable sand

4 to 46 inches—strong brown, very friable loamy sand

*Substratum:*

46 to 80 inches—light yellowish brown sand with bands of brown loamy sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Somewhat excessively drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

### **Composition**

Graycalm soil and similar soils: 85 to 90 percent

Contrasting inclusions: 10 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained Glennie soils

*Similar inclusions:*

- Soils that do not have bands of loamy sand in the substratum

**Use and Management**

*Land use:* Woodland

**Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

**Building sites**

*Major management concerns:* Cutbanks caving, slope

*Management considerations:*

- Because cutbanks are unstable and are subject to caving, trench walls should be reinforced.
- This soil is poorly suited to building site development unless extensive land shaping is feasible.

**Septic tank absorption fields**

*Major management concerns:* Slope, rapid permeability

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

**Interpretive Groups**

*Land capability classification:* V1s

*Woodland ordination symbol:* 6R

*Michigan soil management group:* 5a

**17B—Croswell sand, 0 to 6 percent slopes****Setting**

*Landform:* Outwash plains, till plains, and lake plains

*Shape of areas:* Linear or irregular

*Size of areas:* 5 to 300 acres

**Typical Profile***Surface layer:*

0 to 4 inches—very dark gray sand

*Subsurface layer:*

4 to 7 inches—light gray sand

*Subsoil:*

7 to 11 inches—dark brown, very friable sand

11 to 36 inches—yellowish brown and brownish yellow, loose sand

*Substratum:*

36 to 60 inches—brownish yellow, mottled sand

60 to 80 inches—pale brown sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Moderately well drained

*Seasonal high water table:* Apparent, at a depth of 2.0 to 3.5 feet at some time from November through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

**Composition**

Croswell soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

**Inclusions***Contrasting inclusions:*

- The moderately well drained, sandy over loamy Morganlake soils
- The very poorly drained Leafriver soils

*Similar inclusions:*

- Soils that have a surface layer of loamy sand
- Soils that do not have a dark brown subsoil layer
- Soils that are somewhat poorly drained

**Use and Management**

*Dominant land use:* Woodland

*Other uses:* Cropland, pasture

**Cropland**

*Major management concerns:* Low content of organic matter, soil blowing, seasonal droughtiness, nutrient and pesticide loss

*Management considerations:*

- Conservation tillage, windbreaks, crop residue

management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. Maintaining a permanent plant cover also helps to control soil blowing.

- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Increasing the content of organic matter in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and can minimize the pollution of ground water.
- The nutrients in manure and fertilizer applications should not exceed the requirements of the plants.
- The rate of water infiltration can be increased by growing cover crops, leaving crop residue on the surface, and regularly adding other organic material.
- Including green manure crops in the cropping sequence, applying a system of conservation tillage, and properly managing crop residue increase the content of organic matter.

#### **Pasture**

*Major management concerns:* Seasonal droughtiness, overgrazing

*Management considerations:*

- Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests can help to ensure the maximum growth of plants, especially legumes.

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

#### **Building sites**

*Major management concerns:* Cutbanks caving, seasonal wetness

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

#### **Septic tank absorption fields**

*Major management concerns:* Rapid permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

#### **Interpretive Groups**

*Land capability classification:* IVs

*Woodland ordination symbol:* 5S

*Michigan soil management group:* 5a

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

#### **Setting**

*Landform:* Lake plains, till plains, and outwash plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 200 acres

#### **Typical Profile**

*Surface layer:*

0 to 3 inches—black, partially decomposed leaf litter

*Subsurface layer:*

3 to 9 inches—pinkish gray, mottled sand

*Subsoil:*

9 to 14 inches—dark reddish brown and dark brown, mottled, very friable sand

14 to 29 inches—yellowish brown, mottled, loose sand

*Substratum:*

29 to 80 inches—very pale brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

### **Composition**

Au Gres soil and similar soils: 90 to 95 percent

Contrasting inclusions: 5 to 10 percent

### **Inclusions**

*Contrasting inclusions:*

- The excessively drained Grayling soils
- The very poorly drained Deford soils

*Similar inclusions:*

- Soils that are moderately well drained
- Soils that do not have a dark reddish brown or dark brown subsoil

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Cropland, pasture

#### **Cropland**

*Major management concerns:* Seasonal wetness, soil blowing, nutrient and pesticide loss

*Management considerations:*

- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. Maintaining a permanent plant cover also helps to control soil blowing.
- Increasing the content of organic matter in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and can minimize the pollution of ground water.
- The nutrients in manure and fertilizer applications should not exceed the requirements of the plants.
- Subsurface drains can reduce the wetness if a suitable outlet is available.

#### **Pasture**

*Major management concerns:* Seasonal droughtiness, seasonal wetness, overgrazing

*Management considerations:*

- Proper stocking rates, uniform distribution of grazing, deferred grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests can help to ensure the maximum growth of plants.

#### **Woodland**

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition, seedling mortality, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Trees that can withstand seasonal wetness should be selected for planting.
- Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

#### **Building sites**

*Major management concerns:* Cutbanks caving, seasonal wetness

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

#### **Septic tank absorption fields**

*Major management concerns:* Rapid permeability, seasonal wetness

*Management considerations:*

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

### **Interpretive Groups**

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

## **19—Leafriver muck**

### **Setting**

*Landform:* Lake plains, outwash plains, and moraines  
*Shape of areas:* Linear or irregular  
*Size of areas:* 5 to 100 acres

### **Typical Profile**

*Surface layer:*  
 0 to 10 inches—black muck  
 10 to 14 inches—black sand  
 14 to 35 inches—dark brownish gray, loose sand

*Substratum:*  
 35 to 60 inches—dark gray sand  
 60 to 80 inches—brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid  
*Available water capacity:* Moderate  
*Drainage class:* Very poorly drained  
*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from November through July  
*Surface runoff:* Very slow or ponded  
*Flooding:* None  
*Hazard of water erosion:* Slight  
*Hazard of soil blowing:* Moderate  
*Shrink-swell potential:* Low  
*Potential for frost action:* High

### **Composition**

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

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained Croswell soils
- The somewhat poorly drained Au Gres soils

*Similar inclusions:*

- Soils that have a thinner organic layer
- Soils that have a thicker organic layer

### **Use and Management**

*Land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations,

seedling mortality, windthrow hazard, plant competition, seasonal wetness

#### *Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Landing sites generally can be used only during the driest time of the year.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Special harvest methods may be needed to control undesirable plants.
- Carefully managed reforestation helps to control undesirable understory plants.
- Because of wetness, severe seedling mortality, and plant competition, trees are generally not planted on this soil.

#### **Building sites**

*Major management concerns:* Ponding

- Because of ponding, this soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Ponding  
*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

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

## **25B—Kent sandy loam, 2 to 6 percent slopes**

### **Setting**

*Landform:* Till plains  
*Shape of areas:* Irregular  
*Size of areas:* 5 to 120 acres

### **Typical Profile**

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

**Subsoil:**

- 8 to 14 inches—dark brown, firm clay and grayish brown, firm loam
- 14 to 26 inches—reddish brown, firm clay
- 26 to 40 inches—dark brown, mottled, firm clay

**Substratum:**

40 to 80 inches—brown clay

**Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* Moderate

*Drainage class:* Moderately well drained

*Seasonal high water table:* Perched at a depth of 2.0 to 3.5 feet at some time from November through May

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* High

*Potential for frost action:* Moderate

**Composition**

Kent soil and similar soils: 85 to 90 percent

Contrasting inclusions: 10 to 15 percent

**Inclusions****Contrasting inclusions:**

- The somewhat poorly drained Selkirk soils
- The moderately well drained, sandy over loamy Morganlake soils
- The poorly drained Sims soils

**Similar inclusions:**

- Soils that have a sandy substratum
- Soils that have less clay in the subsoil
- Soils that have a surface layer of loam
- Soils that are eroded and have a surface layer of clay loam

**Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

**Cropland**

*Major management concerns:* Water erosion, tilling in the surface layer, soil compaction, restricted permeability

**Management considerations:**

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.

- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

**Pasture**

*Major management concerns:* Compaction

**Management considerations:**

- Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

**Woodland**

*Major management concerns:* Plant competition, equipment limitations, windthrow hazard

**Management considerations:**

- Carefully managed reforestation helps to control undesirable understory plants.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Because of the restricted permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

**Building sites**

*Major management concerns:* Shrink-swell, seasonal wetness

**Management considerations:**

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

**Septic tank absorption fields**

*Major management concerns:* Restricted permeability, seasonal wetness

**Management considerations:**

- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

- Filling or mounding with suitable material helps to raise the absorption field above the water table.

### **Interpretive Groups**

*Land capability classification:* IIIe

*Woodland ordination symbol:* 8C

*Michigan soil management group:* 1a

## **25C—Kent sandy loam, 6 to 12 percent slopes**

### **Setting**

*Landform:* Till plains and moraines

*Shape of areas:* Irregular

*Size of areas:* 5 to 50 acres

### **Typical Profile**

*Surface layer:*

0 to 8 inches—very dark grayish brown sandy loam

*Subsoil:*

8 to 14 inches—dark brown, firm clay and grayish brown, firm loam

14 to 26 inches—reddish brown, firm clay

26 to 40 inches—dark brown, mottled, firm clay

*Substratum:*

40 to 80 inches—brown clay

### **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* Moderate

*Drainage class:* Moderately well drained

*Seasonal high water table:* Perched at a depth of 2.0 to 3.5 feet at some time from November through May

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* High

*Potential for frost action:* Moderate

### **Composition**

Kent soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained, sandy over loamy Morganlake soils
- The somewhat poorly drained Selkirk soils
- The poorly drained Sims soils

*Similar inclusions:*

- Soils that have a sandy substratum
- Soils that have less clay in the subsoil
- Soils that are eroded and have a surface layer of clay loam

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

#### **Cropland**

*Major management concerns:* Water erosion, soil compaction, tilth in the surface layer, restricted permeability

*Management considerations:*

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Shaping and maintaining grassed waterways promote the safe removal of runoff from the fields.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

#### **Pasture**

*Major management concerns:* Compaction

*Management considerations:*

- Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

#### **Woodland**

*Major management concerns:* Plant competition, equipment limitations, windthrow hazard

*Management considerations:*

- Carefully managed reforestation helps to control undesirable understory plants.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Because of the restricted permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced

and by such harvest methods as selective cutting and strip cutting.

### **Building sites**

*Major management concerns:* Shrink-swell, slope, seasonal wetness

*Management considerations:*

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

### **Septic tank absorption fields**

*Major management concerns:* Restricted permeability, slope, seasonal wetness

*Management considerations:*

- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

### **Interpretive Groups**

*Land capability classification:* IIIe

*Woodland ordination symbol:* 8C

*Michigan soil management group:* 1a

## **26B—Cublake sand, 0 to 6 percent slopes**

### **Setting**

*Landform:* Lake plains and outwash plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 50 acres

### **Typical Profile**

*Surface layer:*

0 to 3 inches—black sand

*Subsurface layer:*

3 to 5 inches—brown sand

*Subsoil:*

5 to 10 inches—dark brown, very friable sand

10 to 13 inches—dark yellowish brown, very friable sand

13 to 24 inches—brownish yellow, loose sand

*Substratum:*

24 to 45 inches—pale brown and very pale brown, mottled sand

45 to 80 inches—brown, stratified, mottled very fine sandy loam and silt loam

### **Soil Properties and Qualities**

*Permeability:* Rapid in the sandy part and moderately slow in the loamy part

*Available water capacity:* Low

*Drainage class:* Moderately well drained

*Seasonal high water table:* Perched at a depth of 2.0 to 3.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

### **Composition**

Cublake soil and similar soils: 90 to 95 percent

Contrasting inclusions: 5 to 10 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat excessively drained Graycalm soils
- The very poorly drained Wakeley soils

*Similar inclusions:*

- Soils that have more clay in the substratum
- Soils that have a surface layer of loamy sand
- Soils that do not have mottles in the subsoil and the substratum

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Cropland, pasture

### **Cropland**

*Major management concerns:* Low content of organic matter, soil blowing, seasonal droughtiness, nutrient and pesticide loss

*Management considerations:*

- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. Maintaining a permanent plant cover also helps to control soil blowing.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.

- Increasing the content of organic matter in the root zone may increase the ability of the soil to hold water, nutrients, and pesticides and can minimize the pollution of ground water.
- The nutrients in manure and fertilizer applications should not exceed the requirements of the plants.
- Including green manure crops in the cropping sequence, applying a system of conservation tillage, and properly managing crop residue increase the content of organic matter.

### **Pasture**

*Major management concerns:* Seasonal droughtiness, overgrazing

*Management considerations:*

- Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests can help to ensure the maximum growth of plants, especially legumes.

### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, plant competition, windthrow hazard, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

### **Building sites**

*Major management concerns:* Cutbanks caving, seasonal wetness

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Buildings can be constructed on well compacted fill

material, which raises the site a sufficient distance above the water table.

### **Septic tank absorption fields**

*Major management concerns:* Rapid permeability, seasonal wetness, restricted permeability

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable fill material helps to raise the absorption field above the water table.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IVs

*Woodland ordination symbol:* 7A

*Michigan soil management group:* 5a

## **27A—Tacoda sand, 0 to 3 percent slopes**

### **Setting**

*Landform:* Lake plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 50 acres

### **Typical Profile**

*Surface layer:*

0 to 3 inches—black sand

*Subsurface layer:*

3 to 15 inches—light gray, mottled sand

*Subsoil:*

15 to 23 inches—dark brown, mottled, friable sand  
23 to 45 inches—very pale brown, light yellowish brown, and brown, mottled, loose sand

*Substratum:*

45 to 80 inches—dark brown and brown, mottled silty clay

### **Soil Properties and Qualities**

*Permeability:* Rapid in the sandy part and very slow in the loamy part

*Available water capacity:* Low

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Perched at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

### **Composition**

Tacoda soil and similar soils: 90 to 95 percent

Contrasting inclusions: 5 to 10 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Wakeley soils

*Similar inclusions:*

- Soils that are moderately well drained
- Soils that have no clay in the substratum
- Soils that have a cemented subsoil

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Pasture

#### **Pasture**

*Major management concerns:* Seasonal droughtiness, seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, deferred grazing during wet periods, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests can help to ensure the maximum growth of plants.

#### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seedling mortality, windthrow hazard, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Trees that can withstand seasonal wetness should be selected for planting.
- Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced

and by such harvest methods as selective cutting and strip cutting.

#### **Building sites**

*Major management concerns:* Cutbanks caving, seasonal wetness

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

#### **Septic tank absorption fields**

*Major management concerns:* Rapid permeability, restricted permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IVw

*Woodland ordination symbol:* 4W

*Michigan soil management group:* 5b

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

### **Setting**

*Landform:* Outwash plains and lake terraces

*Shape of areas:* Irregular

*Size of area:* 220 acres

### **Typical Profile**

*Surface layer:*

0 to 4 inches—black sand

*Subsurface layer:*

4 to 7 inches—grayish brown sand

*Subsoil:*

7 to 20 inches—dark brown and strong brown, very friable loamy sand

20 to 30 inches—strong brown, very friable sand

*Substratum:*

30 to 80 inches—brown, stratified sand and very gravelly loamy coarse sand

### **Soil Properties and Qualities**

*Permeability:* Rapid in the sandy surface layer and subsoil and very rapid in the substratum

*Available water capacity:* Low

*Drainage class:* Somewhat excessively drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

### **Composition**

East Lake soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The excessively drained Grayling soils

*Similar inclusions:*

- Soils that have a loamy layer in the subsoil
- Soils that are moderately well drained

### **Use and Management**

*Land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

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

#### **Building sites**

*Major management concerns:* Cutbanks caving

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

#### **Septic tank absorption fields**

*Major management concerns:* Rapid permeability

*Management considerations:*

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

### **Interpretive Groups**

*Land capability classification:* IVs

*Woodland ordination symbol:* 2S

*Michigan soil management group:* 5a

## **39B—Glennie loamy sand, 0 to 6 percent slopes**

### **Setting**

*Landform:* Ground moraines

*Shape of areas:* Irregular

*Size of areas:* 10 to 20 acres

### **Typical Profile**

*Organic mat:*

0 to 2 inches—black, partially decomposed forest litter

*Surface layer:*

2 to 3 inches—black loamy sand

*Subsurface layer:*

3 to 7 inches—grayish brown loamy sand

*Subsoil:*

7 to 11 inches—dark brown, friable sandy loam

11 to 20 inches—strong brown, friable loamy sand

20 to 40 inches—brown, firm, brittle loamy sand and reddish brown, firm, brittle loam

40 to 46 inches—reddish brown, mottled, very firm, brittle sandy clay loam and brown, mottled, very firm, brittle sandy loam

46 to 56 inches—dark reddish brown, mottled, very firm sandy clay loam

56 to 85 inches—reddish brown, very firm sandy clay loam

*Substratum:*

85 to 99 inches—reddish brown sandy clay loam

### **Soil Properties and Qualities**

*Permeability:* Rapid in the loamy sand part and very slow in the loamy and clayey parts

*Available water capacity:* Moderate

*Drainage class:* Moderately well drained

*Seasonal high water table:* Perched at a depth of 2.5 to 3.5 feet at some time from November through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

### **Composition**

Glennie soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Wakeley soils

*Similar inclusions:*

- Soils that are well drained
- Soils that have 20 inches of sand at the surface

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Pasture, cropland

#### **Cropland**

*Major management concerns:* Soil blowing, droughtiness, nutrient and pesticide loss, seasonal wetness

*Management considerations:*

- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. Maintaining a permanent plant cover also helps to control soil blowing.
- The rate of water infiltration can be increased by growing cover crops, leaving crop residue on the surface, and regularly adding other organic material.
- Growing grasses and legumes in rotation can reduce nutrient losses, improve soil structure, and provide nitrogen for use by succeeding crops.
- Wetness may delay soil preparation and planting in the spring.

#### **Pasture**

*Major management concerns:* Overgrazing, seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.

#### **Woodland**

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition

*Management considerations:*

- Skidders should not be used during wet periods, when ruts form easily.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

#### **Building sites**

*Major management concerns:* Cutbanks caving, seasonal wetness

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

#### **Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, restricted permeability

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IIIs

*Woodland ordination symbol:* 5D

*Michigan soil management group:* 4/2a-f

## **39C—Glennie loamy sand, 6 to 12 percent slopes**

### **Setting**

*Landform:* Ground moraines

*Shape of areas:* Irregular

*Size of areas:* 153 acres

### Typical Profile

*Organic mat:*

0 to 2 inches—black, partially decomposed forest litter

*Surface layer:*

2 to 3 inches—black loamy sand

*Subsurface layer:*

3 to 7 inches—grayish brown loamy sand

*Subsoil:*

7 to 11 inches—dark brown, friable sandy loam

11 to 20 inches—strong brown, friable loamy sand

20 to 40 inches—brown, firm, brittle loamy sand and reddish brown, firm, brittle loam

40 to 46 inches—reddish brown, mottled, very firm, brittle sandy clay loam and brown, mottled, very firm, brittle sandy loam

46 to 56 inches—dark reddish brown, mottled, very firm sandy clay loam

56 to 85 inches—reddish brown, very firm sandy clay loam

*Substratum:*

85 to 99 inches—reddish brown sandy clay loam

### Soil Properties and Qualities

*Permeability:* Rapid in the sandy part and very slow in the loamy and clayey parts

*Available water capacity:* Moderate

*Drainage class:* Moderately well drained

*Seasonal high water table:* Perched at a depth of 2.5 to 3.5 feet at some time from November through May

*Surface runoff:* Slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

### Composition

Glennie soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### Inclusions

*Contrasting inclusions:*

- The somewhat excessively drained Graycalm soils
- The very poorly drained Wakeley soils

*Similar inclusions:*

- Soils that are well drained

### Use and Management

*Land use:* Woodland

### Woodland

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition

*Management considerations:*

- Skidders should not be used during wet periods, when ruts form easily.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

### Building sites

*Major management concerns:* Cutbanks caving, seasonal wetness, slope

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

### Septic tank absorption fields

*Major management concerns:* Restricted permeability, seasonal wetness, slope

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

### Interpretive Groups

*Land capability classification:* IIIe

*Woodland ordination symbol:* 5D

*Michigan soil management group:* 4/2a-f

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

### Setting

*Landform:* Ground moraines

*Shape of areas:* Irregular

*Size of areas:* 25 to 60 acres

### Typical Profile

*Surface layer:*

0 to 5 inches—very dark gray sandy loam

*Subsurface layer:*

5 to 13 inches—brown, mottled sandy loam

*Subsoil:*

13 to 28 inches—brown, mottled, firm sandy loam and loam

28 to 44 inches—dark brown and brown, mottled, firm loam

*Substratum:*

44 to 80 inches—brown, mottled loam

### Soil Properties and Qualities

*Permeability:* Moderately slow

*Available water capacity:* Moderate

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Moderate

*Potential for frost action:* High

### Composition

Sprinkler soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### Inclusions

*Contrasting inclusions:*

- The moderately well drained Glennie soils

*Similar inclusions:*

- Soils that have more sand in the surface layer

### Use and Management

*Dominant land use:* Woodland

*Other uses:* Cropland, pasture

#### Cropland

*Major management concerns:* Seasonal wetness, soil blowing, nutrient and pesticide loss

*Management considerations:*

- Most adapted crops can be grown if an adequate drainage system is installed.
- The nutrients in manure and fertilizer applications should not exceed the requirements of the plants.
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.

#### Pasture

*Major management concerns:* Overgrazing, seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants.

#### Woodland

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Special harvest methods may be needed to control undesirable plants.
- Carefully managed reforestation helps to control undesirable understory plants.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

#### Building sites

*Major management concerns:* Seasonal wetness, shrink-swell

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, restricted permeability

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

**Interpretive Groups**

*Land capability classification:* 1lw

*Woodland ordination symbol:* 3W

*Michigan soil management group:* 2.5b

**47D—Graycalm sand, 6 to 18 percent slopes****Setting**

*Landform:* Outwash plains and stream terraces

*Shape of areas:* Irregular

*Size of areas:* 5 to 50 acres

**Typical Profile**

*Surface layer:*

0 to 4 inches—black sand

*Subsoil:*

4 to 16 inches—strong brown, friable sand

16 to 45 inches—yellowish brown, brownish yellow, and yellow, very friable sand

45 to 80 inches—very pale brown, loose sand with bands of strong brown loamy sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Somewhat excessively drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

**Composition**

Graycalm soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

**Inclusions**

*Contrasting inclusions:*

- The moderately well drained Morganlake soils

*Similar inclusions:*

- Soils that have bands of gravelly sand in the subsoil
- Soils that have calcareous sand and gravel below a depth of 60 inches
- Soils that do not have bands of loamy sand in the subsoil

**Use and Management**

*Land use:* Woodland

**Woodland**

*Major management concerns:* Erosion hazard, equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- The grade should be kept as low as possible.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.

**Building sites**

*Major management concerns:* Cutbanks caving, slope

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

**Septic tank absorption fields**

*Major management concerns:* Rapid permeability, slope

*Management considerations:*

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

- Land shaping and installing the distribution lines on the contour help to overcome the slope.

### **Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* 6S

*Michigan soil management group:* 5a

## **47F—Graycalm sand, 18 to 45 percent slopes**

### **Setting**

*Landform:* Escarpments on stream terraces

*Shape of areas:* Linear

*Size of areas:* 5 to 25 acres

### **Typical Profile**

*Surface layer:*

0 to 4 inches—black sand

*Subsoil:*

4 to 16 inches—strong brown, friable sand

16 to 45 inches—yellowish brown, brownish yellow, and yellow, very friable sand

45 to 80 inches—very pale brown, loose sand with bands of strong brown loamy sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Somewhat excessively drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

### **Composition**

Graycalm soil and similar soils: 95 to 100 percent

Contrasting inclusions: 0 to 5 percent

### **Inclusions**

*Contrasting inclusions:*

- The well drained, sandy over loamy Menominee soils

*Similar inclusions:*

- Soils that do not have bands of loamy sand in the substratum

## **Use and Management**

*Land use:* Woodland

### **Woodland**

*Major management concerns:* Equipment limitations, erosion hazard, seedling mortality, seasonal droughtiness, slope

*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely because of the slope. As a result, special logging methods, such as yarding the logs with a cable, may be needed.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate. Planting when the soil is moist can also reduce the seedling mortality rate.

### **Building sites**

*Major management concerns:* Slope

*Management considerations:*

- Because of the slope, this soil is generally unsuited to building site development.

### **Septic tank absorption fields**

*Major management concerns:* Slope

*Management considerations:*

- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

## **Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* 6R

*Michigan soil management group:* 5a

## 53B—Negwegon silt loam, 2 to 6 percent slopes

### Setting

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

### Typical Profile

*Surface layer:*  
 0 to 6 inches—very dark grayish brown silt loam

*Subsoil:*  
 6 to 10 inches—dark brown, firm clay and pale brown, firm silt loam  
 10 to 34 inches—dark brown and strong brown, firm clay

*Substratum:*  
 34 to 80 inches—light brown, mottled silty clay loam

### Soil Properties and Qualities

*Permeability:* Very slow  
*Available water capacity:* High  
*Drainage class:* Moderately well drained  
*Seasonal high water table:* Perched at a depth of 2.0 to 3.5 feet at some time from November through May  
*Surface runoff:* Medium  
*Flooding:* None  
*Hazard of water erosion:* Moderate  
*Hazard of soil blowing:* Slight  
*Shrink-swell potential:* High  
*Potential for frost action:* Moderate

### Composition

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

### Inclusions

*Contrasting inclusions:*

- The moderately well drained, sandy over loamy Skeel soils
- The poorly drained Springport soils

*Similar inclusions:*

- Soils that have sandy layers below a depth of 60 inches
- Soils that have a surface layer of loamy sand
- Soils that have clay loam till below a depth of 60 inches

### Use and Management

*Dominant land use:* Cropland  
*Other uses:* Pasture, woodland

### Cropland

*Major management concerns:* Water erosion, seasonal wetness, restricted permeability, tilth in the surface layer, soil compaction, nutrient and pesticide loss

*Management considerations:*

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
- Most adapted crops can be grown if an adequate drainage system is installed.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
- Conservation tillage systems, contour farming, cover crops, and sod-based rotations can minimize the detachment and loss of nutrients associated with sediment and thus help to prevent the loss of solid-phase nitrogen and phosphorus.

### Pasture

*Major management concerns:* Seasonal wetness, compaction

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

### Woodland

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- Because of the restricted permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.
- Skidders should not be used during wet periods, when ruts form easily.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.

- Special harvest methods may be needed to control undesirable plants.
- Species preference can be managed by selective cutting.

### **Building sites**

*Major management concerns:* Shrink-swell, seasonal wetness

*Management considerations:*

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

### **Septic tank absorption fields**

*Major management concerns:* Restricted permeability, seasonal wetness

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IIIe

*Woodland ordination symbol:* 3L

*Michigan soil management group:* 1a

## **53C—Negwagon silt loam, 6 to 12 percent slopes**

### **Setting**

*Landform:* Ridges and knolls on lake plains

*Shape of areas:* Irregular

*Size of areas:* 10 to 50 acres

### **Typical Profile**

*Surface layer:*

0 to 6 inches—very dark grayish brown silt loam

*Subsoil:*

6 to 10 inches—dark brown, firm clay and pale brown, firm silt loam

10 to 34 inches—dark brown and brown, firm clay

*Substratum:*

34 to 80 inches—light brown, mottled silty clay loam

### **Soil Properties and Qualities**

*Permeability:* Very slow

*Available water capacity:* High

*Drainage class:* Moderately well drained

*Seasonal high water table:* Perched at a depth of 2.0 to 3.5 feet at some time from November through May

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* High

*Potential for frost action:* Moderate

### **Composition**

Negwagon soil and similar soils: 90 to 95 percent

Contrasting inclusions: 5 to 10 percent.

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained, sandy over loamy Skeel soils

*Similar inclusions:*

- Soils that are well drained
- Soils that have a surface layer of loamy sand
- Soils that have clay loam till below a depth of 60 inches

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

### **Cropland**

*Major management concerns:* Water erosion, seasonal wetness, restricted permeability, tilth in the surface layer, soil compaction, nutrient and pesticide loss

*Management considerations:*

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
- Growing grasses and legumes for pasture or hay is effective in controlling erosion.
- Shaping and maintaining grassed waterways promote the safe removal of runoff from the fields.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Minimizing tillage and tilling and harvesting at the

proper soil moisture content help to prevent excessive compaction and maintain tilth.

- Conservation tillage systems, contour farming, cover crops, and sod-based rotations can minimize the detachment and loss of nutrients associated with sediment and thus help to prevent the loss of solid-phase nitrogen and phosphorus.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.

### **Pasture**

*Major management concerns:* Seasonal wetness, compaction

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

### **Woodland**

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- Because of the restricted permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.
- Skidders should not be used during wet periods, when ruts form easily.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Species preference can be managed by selective cutting.

### **Building sites**

*Major management concerns:* Shrink-swell, seasonal wetness, slope

*Management considerations:*

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

### **Septic tank absorption fields**

*Major management concerns:* Restricted permeability, seasonal wetness, slope

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

### **Interpretive Groups**

*Land capability classification:* IIIe

*Woodland ordination symbol:* 3L

*Michigan soil management group:* 1a

## **54A—Algonquin silt loam, 0 to 3 percent slopes**

### **Setting**

*Landform:* Lake plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 20 acres

### **Typical Profile**

*Surface layer:*

0 to 7 inches—dark brown, mottled silt loam

*Subsoil:*

7 to 11 inches—reddish brown, mottled, firm silty clay

11 to 14 inches—reddish brown, mottled, firm silty clay loam

14 to 80 inches—light reddish brown, mottled, firm silty clay

### **Soil Properties and Qualities**

*Permeability:* Very slow

*Available water capacity:* High

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Perched at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* High

*Potential for frost action:* High

### **Composition**

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

### **Inclusions**

#### *Contrasting inclusions:*

- The moderately well drained Negwegon soils
- The somewhat poorly drained, sandy over loamy Allendale soils

#### *Similar inclusions:*

- Soils that have a thin surface layer of sandy loam

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

#### **Cropland**

*Major management concerns:* Seasonal wetness, restricted permeability, soil compaction, tith in the surface layer

#### *Management considerations:*

- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tith.

#### **Pasture**

*Major management concerns:* Compaction, seasonal wetness

#### *Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tith.

#### **Woodland**

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition, seedling mortality, seasonal wetness

#### *Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Because of the restricted permeability and the sticky

and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.

- Skidders should not be used during wet periods, when ruts form easily.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Trees that can withstand seasonal wetness should be selected for planting.

#### **Building sites**

*Major management concerns:* Shrink-swell, seasonal wetness

#### *Management considerations:*

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

#### **Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, restricted permeability

#### *Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IIIw

*Woodland ordination symbol:* 6W

*Michigan soil management group:* 1b

## **55—Springport clay loam**

### **Setting**

*Landform:* Lake plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 5 to 20 acres

### **Typical Profile**

*Surface layer:*

0 to 8 inches—very dark gray clay loam

*Subsoil:*

8 to 12 inches—grayish brown, mottled, firm clay  
12 to 27 inches—reddish brown, mottled, firm silty clay

*Substratum:*

27 to 80 inches—reddish brown, mottled silty clay

### **Soil Properties and Qualities**

*Permeability:* Very slow

*Available water capacity:* High

*Drainage class:* Poorly drained

*Seasonal high water table:* Perched 1 foot above to 1 foot below the surface at some time from October through June

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* High

*Potential for frost action:* High

### **Composition**

Springport soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained Negwegon soils
- The somewhat poorly drained Algonquin soils

*Similar inclusions:*

- Soils that have a mucky surface layer

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Pasture, cropland

#### **Cropland**

*Major management concerns:* Seasonal wetness, tilth in the surface layer, soil compaction, restricted permeability, ponding

*Management considerations:*

- Shallow surface ditches help to remove surface water after heavy rains.
- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes

in the cropping sequence improve soil structure, water infiltration, and permeability.

- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

#### **Pasture**

*Major management concerns:* Seasonal wetness, compaction

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Because of the restricted permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.
- Skidders should not be used during wet periods, when ruts form easily.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

#### **Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* IIIw  
*Woodland ordination symbol:* 6W  
*Michigan soil management group:* 1c

## **56C—Nester loam, 6 to 12 percent slopes**

### **Setting**

*Landform:* Till plains and moraines  
*Shape of areas:* Irregular  
*Size of area:* 51 acres

### **Typical Profile**

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

*Subsoil:*  
 9 to 19 inches—brown sandy loam and reddish brown, mottled, firm clay loam  
 19 to 40 inches—reddish brown, mottled, firm clay loam

*Substratum:*  
 40 to 80 inches—light reddish brown clay loam

### **Soil Properties and Qualities**

*Permeability:* Slow  
*Available water capacity:* High  
*Drainage class:* Moderately well drained  
*Seasonal high water table:* Perched at a depth of 2.5 to 3.5 feet at some time from November through May  
*Surface runoff:* Medium  
*Flooding:* None  
*Hazard of water erosion:* Moderate  
*Hazard of soil blowing:* Slight  
*Shrink-swell potential:* Moderate  
*Potential for frost action:* Moderate

### **Composition**

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

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained, sandy over loamy Morganlake soils
- The somewhat poorly drained Kawkawlin soils

*Similar inclusions:*

- Soils that do not have mottles in the subsoil
- Soils that have a surface layer of sandy loam

### **Use and Management**

*Dominant land use:* Woodland  
*Other uses:* Cropland, pasture

#### **Cropland**

*Major management concerns:* Water erosion, soil compaction, tillage in the surface layer, seasonal wetness, nutrient and pesticide loss, restricted permeability

#### *Management considerations:*

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
- Shaping and maintaining grassed waterways promote the safe removal of runoff from the fields.
- Conservation tillage systems, contour farming, cover crops, and sod-based rotations can minimize the detachment and loss of nutrients associated with sediment and thus help to prevent the loss of solid-phase nitrogen and phosphorus.
- Most adapted crops can be grown if an adequate drainage system is installed.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tillage.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.

#### **Pasture**

*Major management concerns:* Seasonal wetness, compaction, overgrazing

#### *Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tillage.
- Applying lime and fertilizer according to the results of soil tests can help to ensure the maximum growth of plants, especially legumes.

#### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seasonal wetness

#### *Management considerations:*

- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.

- Skidders should not be used during wet periods, when ruts form easily.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

### **Building sites**

*Major management concerns:* Seasonal wetness, shrink-swell, slope

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

### **Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, restricted permeability, slope

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

### **Interpretive Groups**

*Land capability classification:* IIIe

*Woodland ordination symbol:* 3L

*Michigan soil management group:* 1.5a

## **57B—Kawkawlin loam, 1 to 4 percent slopes**

### **Setting**

*Landform:* Till plains and moraines

*Shape of areas:* Irregular

*Size of areas:* 5 to 150 acres

### **Typical Profile**

*Surface layer:*

0 to 10 inches—very dark grayish brown loam

*Subsoil:*

10 to 15 inches—grayish brown, friable fine sandy loam and dark brown, mottled, friable clay loam

15 to 29 inches—dark yellowish brown, mottled, friable clay loam

*Substratum:*

29 to 44 inches—reddish brown, mottled clay loam

44 to 80 inches—brown clay loam

### **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* High

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Perched at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* Moderate

*Potential for frost action:* High

### **Composition**

Kawkawlin soil and similar soils: 90 to 95 percent

Contrasting inclusions: 5 to 10 percent

### **Inclusions**

*Contrasting inclusions:*

- The poorly drained Sims soils
- The moderately well drained Nester soils

*Similar inclusions:*

- Soils that have a surface layer of loamy sand
- Soils that have sandy layers below a depth of 60 inches

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Woodland, pasture

### **Cropland**

*Major management concerns:* Water erosion, seasonal wetness, till in the surface layer, nutrient and pesticide loss

*Management considerations:*

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Shallow surface ditches help to remove surface water after heavy rains.

- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
- Conservation tillage systems, contour farming, cover crops, and sod-based rotations can minimize the detachment and loss of nutrients associated with sediment and thus help to prevent the loss of solid-phase nitrogen and phosphorus.

### **Pasture**

*Major management concerns:* Seasonal wetness, overgrazing, compaction

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Applying lime and fertilizer according to the results of soil tests can help to ensure the maximum growth of plants.

### **Woodland**

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Trees that can withstand seasonal wetness should be selected for planting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

### **Building sites**

*Major management concerns:* Seasonal wetness, shrink-swell

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

### **Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, restricted permeability

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IIe

*Woodland ordination symbol:* 3W

*Michigan soil management group:* 1.5b

## **58A—Wakeley-Allendale complex, 0 to 3 percent slopes**

### **Setting**

*Landform:* Lake plains

*Slope range:* Wakeley—0 to 2 percent; Allendale—0 to 3 percent

*Shape of areas:* Irregular

*Size of areas:* 25 to 200 acres

### **Typical Profile**

#### **Wakeley**

*Surface layer:*

0 to 5 inches—black muck

*Substratum:*

5 to 16 inches—dark grayish brown and grayish brown, mottled sand

16 to 27 inches—brown, mottled sand

27 to 80 inches—reddish brown and pinkish gray, mottled clay

#### **Allendale**

*Surface layer:*

0 to 6 inches—very dark brown loamy sand

*Subsurface layer:*

6 to 8 inches—light brownish gray, mottled sand

*Subsoil:*

8 to 18 inches—dark brown and strong brown, mottled, friable sand

18 to 32 inches—pale brown, mottled, loose sand

32 to 36 inches—reddish brown, mottled, very firm clay

*Substratum:*

36 to 80 inches—brown and weak red, mottled clay

### **Soil Properties and Qualities**

*Permeability:* Rapid in the sandy part and very slow in the clayey part

*Available water capacity:* Moderate

*Drainage class:* Wakeley—very poorly drained; Allendale—somewhat poorly drained

*Seasonal high water table:* Wakeley—perched 1 foot above to 1 foot below the surface at some time from October through May; Allendale—perched at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Wakeley—very slow or ponded; Allendale—very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* High

*Potential for frost action:* Moderate

### **Composition**

Wakeley soil and similar soils: 50 to 60 percent

Allendale soil and similar soils: 40 to 50 percent

Contrasting inclusions: 5 to 10 percent

### **Inclusions**

*Contrasting inclusions:*

- The poorly drained, clayey Springport soils
- The somewhat poorly drained, clayey Algonquin soils

*Similar inclusions:*

- Soils that have thinner layers of sand
- Soils that have a thicker surface layer of muck

### **Use and Management**

*Dominant land use:* Woodland

*Other use:* Pasture

#### **Pasture**

*Major management concerns:* Seasonal wetness, overgrazing

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants.

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Trees that can withstand seasonal wetness should be selected for planting on the Allendale soil.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Wakeley soil.

#### **Building sites**

*Major management concerns:* Wakeley—ponding; Allendale—cutbanks caving, seasonal wetness, shrink-swell

*Management considerations:*

- Because cutbanks in areas of the Allendale soil are not stable and are subject to caving, trench walls should be reinforced.
- In areas of the Allendale soil, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling of the Allendale soil.
- Because of ponding, the Wakeley soil is generally unsuited to building site development.

**Septic tank absorption fields**

*Major management concerns:* Wakeley—ponding;  
Allendale—rapid permeability, restricted  
permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of the Allendale soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability in areas of the Allendale soil.
- In areas of the Allendale soil, filling or mounding with suitable material helps to raise the absorption field above the water table.
- Because of ponding, the Wakeley soil is generally unsuited to septic tank absorption fields.

**Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* Wakeley—3W;  
Allendale—4W

*Michigan soil management group:* Wakeley—4/1c;  
Allendale—4/1b

**59B—Algonquin-Springport complex, 0 to 6 percent slopes****Setting**

*Landform:* Lake plains

*Slope range:* Algonquin—0 to 6 percent; Springport—0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 25 acres

**Typical Profile****Algonquin**

*Surface layer:*

0 to 7 inches—dark brown, mottled silt loam

*Subsoil:*

7 to 11 inches—reddish brown, mottled, firm silty clay

11 to 14 inches—reddish brown, mottled, firm silty clay loam

14 to 80 inches—light reddish brown, mottled, firm silty clay

**Springport**

*Surface layer:*

0 to 8 inches—very dark gray clay loam

*Subsoil:*

8 to 12 inches—grayish brown, mottled, firm clay

12 to 27 inches—reddish brown, mottled, firm silty clay

*Substratum:*

27 to 80 inches—reddish brown, mottled silty clay

**Soil Properties and Qualities**

*Permeability:* Very slow

*Available water capacity:* High

*Drainage class:* Algonquin—somewhat poorly drained;  
Springport—poorly drained

*Seasonal high water table:* Algonquin—perched at a depth of 0.5 foot to 1.5 feet at some time from October through May; Springport—perched 1 foot above to 1 foot below the surface at some time from October through June

*Surface runoff:* Algonquin—medium; Springport—very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Algonquin—moderate;  
Springport—slight

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* High

*Potential for frost action:* High

**Composition**

Algonquin soil and similar soils: 60 to 70 percent

Springport soil and similar soils: 30 to 40 percent

Contrasting inclusions: 5 to 10 percent

**Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained, sandy over clayey Allendale soils
- The very poorly drained, sandy over clayey Wakeley soils

*Similar inclusions:*

- Soils that have a mucky surface layer

**Use and Management**

*Dominant land use:* Woodland

*Other uses:* Cropland, pasture

**Cropland**

*Major management concerns:* Algonquin—seasonal wetness, restricted permeability, soil compaction, till in the surface layer, erosion hazard;  
Springport—seasonal wetness, restricted permeability, soil compaction, till in the surface layer, ponding

*Management considerations:*

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops,

and crop residue management help to control runoff and water erosion.

- Both surface and subsurface drainage systems are needed to reduce the wetness.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

### Pasture

*Major management concerns:* Seasonal wetness, compaction

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

### Woodland

*Major management concerns:* Equipment limitations, windthrow hazard, seedling mortality, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Because of the restricted permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.
- Skidders should not be used during wet periods, when ruts form easily.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Springport soil.

### Building sites

*Major management concerns:* Algonquin—shrink-swell,

seasonal wetness; Springport—shrink-swell, ponding

*Management considerations:*

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- In areas of the Algonquin soil, wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- In areas of the Algonquin soil, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Because of ponding, the Springport soil is generally unsuited to building site development.

### Septic tank absorption fields

*Major management concerns:* Algonquin—seasonal wetness, restricted permeability; Springport—ponding

*Management considerations:*

- In areas of the Algonquin soil, filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability in areas of the Algonquin soil.
- Because of ponding, the Springport soil is generally unsuited to septic tank absorption fields.

### Interpretive Groups

*Land capability classification:* IIIw

*Woodland ordination symbol:* 6W

*Michigan soil management group:* Algonquin—1b; Springport—1c

## 62A—Allendale loamy sand, 0 to 3 percent slopes

### Setting

*Landform:* Lake plains and till plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 100 acres

### Typical Profile

*Surface layer:*

0 to 6 inches—very dark brown loamy sand

*Subsurface layer:*

6 to 8 inches—light brownish gray, mottled sand

*Subsoil:*

8 to 18 inches—dark brown and strong brown, mottled, friable sand

18 to 32 inches—pale brown, mottled, loose sand  
 32 to 36 inches—reddish brown, mottled, very firm  
 clay

*Substratum:*

36 to 80 inches—brown and weak red, mottled clay

### **Soil Properties and Qualities**

*Permeability:* Rapid in the sandy part and very slow in the clayey part

*Available water capacity:* Moderate

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Perched at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* High

*Potential for frost action:* Moderate

### **Composition**

Allendale soil and similar soils: 85 to 90 percent

Contrasting inclusions: 10 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained, clayey Algonquin soils
- The very poorly drained Wakeley soils

*Similar inclusions:*

- Soils that have a surface layer of sand

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Pasture, cropland

#### **Cropland**

*Major management concerns:* Seasonal wetness, soil blowing, nutrient and pesticide loss, low content of organic matter, restricted permeability

*Management considerations:*

- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. Maintaining a permanent plant cover also helps to control soil blowing.

- The nutrients in manure and fertilizer applications should not exceed the requirements of the plants.
- Including green manure crops in the cropping sequence, applying a system of conservation tillage, and properly managing crop residue increase the content of organic matter.

#### **Pasture**

*Major management concerns:* Overgrazing, seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants.

#### **Woodland**

*Major management concerns:* Seasonal wetness, equipment limitations, windthrow hazard, plant competition, seedling mortality

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Trees that can withstand seasonal wetness should be selected for planting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

#### **Building sites**

*Major management concerns:* Seasonal wetness, shrink-swell, cutbanks caving

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Wetness can be reduced by installing a drainage

system around structures with basements and crawl spaces.

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

### **Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, rapid permeability, restricted permeability

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IIIw

*Woodland ordination symbol:* 4W

*Michigan soil management group:* 4/1b

## **70—Lupton muck**

### **Setting**

*Landform:* Depressions on lake plains, outwash plains, till plains, and moraines

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 5 to 20 acres

### **Typical Profile**

*Surface layer:*

0 to 30 inches—black muck

*Substratum:*

30 to 80 inches—black and dark reddish brown muck

### **Soil Properties and Qualities**

*Permeability:* Moderately slow to moderately rapid

*Available water capacity:* Very high

*Drainage class:* Very poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1

foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Potential for frost action:* High

### **Composition**

Lupton soil and similar soils: 95 to 100 percent

Contrasting inclusions: 0 to 5 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Deford soils, which have less than 8 inches of muck at the surface

*Similar inclusions:*

- Soils that have less decomposed organic layers in the lower part of the substratum
- Soils that have 16 to 51 inches of muck over sand or loam

### **Use and Management**

*Land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seedling mortality, windthrow hazard, seasonal wetness

*Management considerations:*

- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Selective cutting or cutting in strips and leaving desirable seed trees along the edge of the openings are beneficial for natural regeneration.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

#### **Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

**Interpretive Groups**

*Land capability classification:* Vlw

*Woodland ordination symbol:* 2W

*Michigan soil management group:* Mc

**71—Tawas muck****Setting**

*Landform:* Depressions on lake plains, outwash plains, and till plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 5 to 20 acres

**Typical Profile**

*Surface layer:*

0 to 12 inches—black muck

*Subsoil:*

12 to 24 inches—black, very friable muck

*Substratum:*

24 to 80 inches—light brownish gray sand

**Soil Properties and Qualities**

*Permeability:* Moderately slow to moderately rapid in the mucky part and rapid in the sandy part

*Available water capacity:* High

*Drainage class:* Very poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* High

**Composition**

Tawas soil and similar soils: 90 to 100 percent

Contrasting inclusions: 0 to 10 percent

**Inclusions**

*Contrasting inclusions:*

- The very poorly drained Deford soils, which have less than 8 inches of muck at the surface
- The somewhat poorly drained Au Gres soils

*Similar inclusions:*

- Soils that have thin loamy layers in the substratum
- Soils that have more than 51 inches of muck

**Use and Management**

*Land use:* Woodland

**Woodland**

*Major management concerns:* Equipment limitations, plant competition, seedling mortality, windthrow hazard, seasonal wetness

*Management considerations:*

- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Selective cutting or cutting in strips and leaving desirable seed trees along the edge of the openings are beneficial for natural regeneration.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

**Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

**Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

**Interpretive Groups**

*Land capability classification:* Vlw

*Woodland ordination symbol:* 5W

*Michigan soil management group:* M/4c

**72—Dorval muck****Setting**

*Landform:* In depressions and along drainageways on lake plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 5 to 150 acres

### **Typical Profile**

*Surface layer:*

0 to 5 inches—very dark gray muck

*Subsoil:*

5 to 18 inches—black, friable muck

*Substratum:*

18 to 20 inches—dark grayish brown marl

20 to 80 inches—grayish brown, mottled silty clay

### **Soil Properties and Qualities**

*Permeability:* Moderate or moderately rapid in the mucky part and very slow in the silty clay part

*Available water capacity:* High

*Drainage class:* Very poorly drained

*Seasonal high water table:* Perched 1 foot above to 1 foot below the surface at some time from November through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* High

*Potential for frost action:* High

### **Composition**

Dorval soil and similar soils: 90 to 95 percent

Contrasting inclusions: 5 to 10 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Algonquin soils

*Similar inclusions:*

- Soils that have a sandy or loamy substratum
- Soils that have more than 51 inches of muck

### **Use and Management**

*Land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, windthrow hazard, seedling mortality, plant competition, seasonal wetness

*Management considerations:*

- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Selective cutting or cutting in strips and leaving

desirable seed trees along the edge of the openings are beneficial for natural regeneration.

- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

#### **Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* 2W

*Michigan soil management group:* M/1c

## **75B—Rubicon sand, 0 to 6 percent slopes**

### **Setting**

*Landform:* Outwash plains, stream terraces, till plains, and moraines

*Shape of areas:* Irregular

*Size of areas:* 10 to 200 acres

### **Typical Profile**

*Organic mat:*

0 to 1 inch—undecomposed pine needles

*Surface layer:*

1 to 4 inches—black sand

*Subsurface layer:*

4 to 9 inches—gray sand

*Subsoil:*

9 to 24 inches—dark brown and strong brown, very friable sand

24 to 41 inches—light yellowish brown, loose sand

*Substratum:*

41 to 80 inches—very pale brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

### **Composition**

Rubicon soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained, sandy Croswell soils
- The moderately well drained, sandy over loamy Morganlake soils

*Similar inclusions:*

- Soils that have a lighter colored subsoil
- Soils that have a loamy substratum below a depth of 50 inches
- Soils that have thin bands of loamy sand in the substratum

### **Use and Management**

*Land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate. Replanting is needed in some areas.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

#### **Building sites**

*Major management concerns:* Cutbanks caving

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

#### **Septic tank absorption fields**

*Major management concerns:* Rapid permeability

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the

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

### **Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* 4S

*Michigan soil management group:* 5.3a

## **75D—Rubicon sand, 6 to 18 percent slopes**

### **Setting**

*Landform:* Stream terraces and moraines

*Shape of areas:* Irregular or linear

*Size of areas:* 10 to 50 acres

### **Typical Profile**

*Organic mat:*

0 to 1 inch—undecomposed pine needles

*Surface layer:*

1 to 4 inches—black sand

*Subsurface layer:*

4 to 9 inches—gray sand

*Subsoil:*

9 to 24 inches—dark brown and strong brown, very friable sand

24 to 41 inches—light yellowish brown, loose sand

*Substratum:*

41 to 80 inches—very pale brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Slow or medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

### **Composition**

Rubicon soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained Morganlake soils
- The well drained Menominee soils

*Similar inclusions:*

- Soils that have a lighter colored subsoil
- Soils that have bands of gravelly sand in the substratum
- Soils that have thin bands of loamy sand in the substratum

**Use and Management**

*Land use:* Woodland

**Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- The grade should be kept as low as possible.
- Planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate. Replanting is needed in some areas.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

**Building sites**

*Major management concerns:* Cutbanks caving, slope

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Because of the slope, this soil is poorly suited to building site development unless extensive land shaping is feasible.

**Septic tank absorption fields**

*Major management concerns:* Rapid permeability, slope

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

**Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* 4S

*Michigan soil management group:* 5.3a

**75E—Rubicon sand, 18 to 35 percent slopes****Setting**

*Landform:* Stream terraces and moraines

*Shape of areas:* Linear

*Size of areas:* 5 to 25 acres

**Typical Profile**

*Surface layer:*

0 to 4 inches—black sand

*Subsurface layer:*

4 to 9 inches—gray sand

*Subsoil:*

9 to 24 inches—dark brown and strong brown, very friable sand

24 to 41 inches—light yellowish brown, loose sand

*Substratum:*

41 to 80 inches—very pale brown sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

**Composition**

Rubicon soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

**Inclusions**

*Contrasting inclusions:*

- The well drained Menominee soils
- The moderately well drained Croswell soils

*Similar inclusions:*

- Soils that have a lighter colored subsoil
- Soils that have bands of gravelly sand in the substratum
- Soils that have thin bands of loamy sand in the substratum

**Use and Management**

*Land use:* Woodland

**Woodland**

*Major management concerns:* Slope, erosion hazard, equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The grade should be kept as low as possible.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate. Replanting is needed in some areas.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

**Building sites**

*Major management concerns:* Slope

*Management considerations:*

- Because of the slope, this soil is generally unsuited to building site development.

**Septic tank absorption fields**

*Major management concerns:* Slope

*Management considerations:*

- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

**Interpretive Groups**

*Land capability classification:* VIIIs

*Woodland ordination symbol:* 4R

*Michigan soil management group:* 5.3a

**75F—Rubicon sand, 35 to 70 percent slopes****Setting**

*Landform:* Stream terraces and moraines

*Shape of areas:* Linear

*Size of areas:* 5 to 25 acres

**Typical Profile**

*Surface layer:*

0 to 4 inches—black sand

*Subsurface layer:*

4 to 9 inches—gray sand

*Subsoil:*

9 to 16 inches—dark brown, very friable sand

16 to 24 inches—strong brown, very friable sand

24 to 41 inches—light yellowish brown, loose sand

*Substratum:*

41 to 80 inches—very pale brown sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

**Composition**

Rubicon soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

**Inclusions**

*Contrasting inclusions:*

- The well drained Menominee soils
- The moderately well drained Croswell soils

*Similar inclusions:*

- Soils that have a lighter colored subsoil
- Soils that have bands of gravelly sand in the substratum
- Soils that have thin bands of loamy sand in the substratum

**Use and Management**

*Land use:* Woodland

**Woodland**

*Major management concerns:* Slope, erosion hazard, equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely because of the slope. As a result, special logging methods, such as yarding the logs with a cable, may be needed.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Because loose sand and the slope can hinder the

traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.

- Planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate. Replanting is needed in some areas.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

### **Building sites**

*Major management concerns:* Slope

*Management considerations:*

- Because of the slope, this soil is generally unsuited to building site development.

### **Septic tank absorption fields**

*Major management concerns:* Slope

*Management considerations:*

- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* 4R

*Michigan soil management group:* 5.3a

## **77—Rollaway muck, frequently flooded**

### **Setting**

*Landform:* Flood plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Linear

*Size of area:* 25 acres

### **Typical Profile**

*Surface layer:*

0 to 9 inches—very dark gray muck

*Subsurface layer:*

9 to 13 inches—black, mottled silt loam

*Substratum:*

13 to 18 inches—dark gray, mottled silt loam

18 to 55 inches—dark grayish brown and black loamy sand and sandy loam

55 to 80 inches—brown silty clay

### **Soil Properties and Qualities**

*Permeability:* Moderate in the loamy part and very slow in the silty clay part

*Available water capacity:* High

*Drainage class:* Very poorly drained

*Seasonal high water table:* Apparent, 2 feet above to 1 foot below the surface at some time from January through December

*Surface runoff:* Very slow or ponded

*Flooding:* Frequent

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* High

### **Composition**

Rollaway soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Colonville soils

*Similar inclusions:*

- Soils that have a thinner surface layer of muck

### **Use and Management**

*Land use:* Woodland

### **Woodland**

*Major management concerns:* Equipment limitations, windthrow hazard, seedling mortality, seasonal wetness, plant competition

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Landing sites generally can be used only during the driest time of the year.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

### **Building sites**

*Major management concerns:* Seasonal flooding

*Management considerations:*

- Because of flooding, this soil is generally unsuited to building site development.

**Septic tank absorption fields**

*Major management concerns:* Seasonal flooding

*Management considerations:*

- Because of flooding, this soil is generally unsuited to septic tank absorption fields.

**Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* 3W

*Michigan soil management group:* L-2c

**78—Pits, borrow****Setting**

*Shape of areas:* Irregular or oval

*Size of areas:* 5 to 10 acres

**Composition**

Pits: 90 to 95 percent

Contrasting inclusions: 5 to 10 percent

**Inclusions**

*Contrasting inclusions:*

- Areas of Udorthents or Udipsamments in which regrowth of some vegetation has occurred
- The excessively drained Grayling soils along the edges of the active pit area

**Use and Management**

*Land use:* Source of gravel, sand, or fill material; some areas have been excavated below the seasonal high water table and are ponded.

*Management considerations:*

- Onsite investigation is needed to determine the suitability for specific uses.

**Interpretive Groups**

*Land capability classification:* None assigned

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

**81B—Grayling sand, 0 to 6 percent slopes****Setting**

*Landform:* Outwash plains and deltas

*Shape of areas:* Irregular

*Size of areas:* 10 to 1,000 acres

**Typical Profile**

*Surface layer:*

0 to 3 inches—black sand

*Subsoil:*

3 to 14 inches—dark brown, very friable sand

14 to 41 inches—yellowish brown and light yellowish brown, loose sand

*Substratum:*

41 to 80 inches—very pale brown sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

**Composition**

Grayling soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

**Inclusions**

*Contrasting inclusions:*

- The excessively drained Rubicon soils, which have a darker subsoil than the Grayling soil
- The moderately well drained Croswell soils

*Similar inclusions:*

- Soils that have bands of loamy sand in the substratum

**Use and Management**

*Land use:* Woodland

**Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

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

**Building sites**

*Major management concerns:* Cutbanks caving

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

**Septic tank absorption fields**

*Major management concerns:* Rapid permeability

*Management considerations:*

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

**Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* 4S

*Michigan soil management group:* 5.7a

**81D—Grayling sand, 6 to 18 percent slopes****Setting**

*Landform:* Knolls and low ridges on outwash plains and deltas

*Shape of areas:* Irregular or linear

*Size of areas:* 5 to 100 acres

**Typical Profile**

*Surface layer:*

0 to 3 inches—black sand

*Subsoil:*

3 to 14 inches—dark brown, very friable sand

14 to 41 inches—yellowish brown and light yellowish brown, loose sand

*Substratum:*

41 to 80 inches—very pale brown sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

**Composition**

Grayling soil and similar soils: 90 to 100 percent

Contrasting inclusions: 0 to 10 percent

**Inclusions**

*Contrasting inclusions:*

- The excessively drained Rubicon soils, which have a darker subsoil than the Grayling soil
- The moderately well drained Croswell soils

*Similar inclusions:*

- Soils that have bands of loamy sand in the substratum

**Use and Management**

*Land use:* Woodland

**Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

**Building sites**

*Major management concerns:* Cutbanks caving, slope

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Because of the slope, this soil is poorly suited to building site development unless extensive land shaping is feasible.

**Septic tank absorption fields**

*Major management concerns:* Rapid permeability, slope

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

**Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* 4S

*Michigan soil management group:* 5.7a

## 81E—Grayling sand, 18 to 35 percent slopes

### Setting

*Landform:* Escarpments and breaks to drainageways on deltas and outwash plains

*Shape of areas:* Linear

*Size of areas:* 5 to 50 acres

### Typical Profile

*Surface layer:*

0 to 3 inches—black sand

*Subsoil:*

3 to 14 inches—dark brown, very friable sand

14 to 41 inches—yellowish brown and light yellowish brown, loose sand

*Substratum:*

41 to 80 inches—very pale brown sand

### Soil Properties and Qualities

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

### Composition

Grayling soil and similar soils: 95 to 100 percent

Contrasting inclusions: 0 to 5 percent

### Inclusions

*Contrasting inclusions:*

- The excessively drained Rubicon soils, which have a darker subsoil than the Grayling soil
- The well drained Menominee soils

*Similar inclusions:*

- Soils that have bands of loamy sand in the substratum

### Use and Management

*Land use:* Woodland

#### Woodland

*Major management concerns:* Equipment limitations,

slope, erosion hazard, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The grade should be kept as low as possible.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate. Planting when the soil is moist can also reduce the seedling mortality rate.

### Building sites

*Major management concerns:* Slope

*Management considerations:*

- Because of the slope, this soil is generally unsuited to building site development.

### Septic tank absorption fields

*Major management concerns:* Slope

*Management considerations:*

- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

### Interpretive Groups

*Land capability classification:* VIIs

*Woodland ordination symbol:* 4R

*Michigan soil management group:* 5.7a

## 82C—Udorthents, loamy, nearly level to gently rolling

### Setting

*Landform:* Ridges and knolls on lake plains and moraines

*Slope range:* 0 to 12 percent

*Shape of areas:* Irregular

*Size of areas:* 5 to 25 acres

**Typical Profile***Surface layer:*

0 to 12 inches—very dark grayish brown silty clay loam

*Substratum:*

12 to 80 inches—dark brown and strong brown silty clay loam

**Soil Properties and Qualities**

*Permeability:* Moderately slow

*Available water capacity:* Moderate

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Slow or medium

*Flooding:* None

*Hazard of water erosion:* Slight or moderate

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* Moderate

*Potential for frost action:* Not evaluated

**Composition**

Udorthents and similar soils: 90 to 95 percent

Contrasting inclusions: 5 to 10 percent

**Inclusions***Contrasting inclusions:*

- Active borrow areas

*Similar inclusions:*

- Soils that have more clay in the substratum

**Use and Management**

*Land use:* Idle land

*Management considerations:*

- Onsite investigation is needed to determine the suitability for specific uses.

**Interpretive Groups**

*Land capability classification:* None assigned

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

**82F—Udorthents, loamy, very steep****Setting**

*Landform:* Overburden areas around gypsum quarries

*Slope range:* 35 to 50 percent

*Shape of areas:* Irregular

*Size of areas:* 25 to 500 acres

**Typical Profile***Surface layer:*

0 to 24 inches—dark brown silty clay loam

*Substratum:*

24 to 40 inches—dark brown silty clay loam

40 to 80 inches—brown silty clay loam

**Soil Properties and Qualities**

*Permeability:* Moderately slow

*Available water capacity:* Moderate

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Very rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Moderate

*Potential for frost action:* Not evaluated

**Composition**

Udorthents and similar soils: 90 to 100 percent

Contrasting inclusions: 0 to 10 percent

**Inclusions***Contrasting inclusions:*

- The somewhat poorly drained Algonquin and Allendale soils

*Similar inclusions:*

- Soils that have more clay in the substratum

**Use and Management**

*Land use:* Idle land

*Management considerations:*

- Onsite investigation is needed to determine the suitability for specific uses.

**Interpretive Groups**

*Land capability classification:* None assigned

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

**83B—Udipsamments, nearly level and undulating****Setting**

*Landform:* Flats and low knolls on outwash plains, lake plains, stream terraces, and moraines

*Slope range:* 0 to 6 percent

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

### **Typical Profile**

*Surface layer:*  
 0 to 5 inches—very dark grayish brown loamy sand

*Subsoil:*  
 5 to 32 inches—yellowish brown, loose sand

*Substratum:*  
 32 to 80 inches—pale brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid  
*Available water capacity:* Very low  
*Drainage class:* Excessively drained  
*Seasonal high water table:* At a depth of more than 6 feet  
*Surface runoff:* Very slow  
*Flooding:* None  
*Hazard of water erosion:* Slight  
*Hazard of soil blowing:* Severe  
*Shrink-swell potential:* Low  
*Potential for frost action:* Low

### **Composition**

Udipsamments and similar soils: 90 to 100 percent  
 Contrasting inclusions: 0 to 10 percent

### **Inclusions**

*Contrasting inclusions:*

- Small undisturbed areas of Grayling sand
- Soils that have a surface layer of sandy loam

*Similar inclusions:*

- Soils that have thin bands of sandy loam or gravelly sand below the surface layer

### **Use and Management**

*Land use:* Idle land

*Management considerations:*

- Onsite investigation is needed to determine the suitability for specific uses.
- This map unit consists of sandy areas where the surface layer and part of the subsoil have been removed or disturbed. In some areas the original soil has been covered with sandy fill material. Most areas are barren or only sparsely vegetated.

### **Interpretive Groups**

*Land capability classification:* None assigned  
*Woodland ordination symbol:* None assigned  
*Michigan soil management group:* None assigned

## **84B—Zimmerman loamy fine sand, 0 to 6 percent slopes**

### **Setting**

*Landform:* Deltas  
*Shape of areas:* Irregular  
*Size of area:* 20 acres

### **Typical Profile**

*Surface layer:*  
 0 to 2 inches—black loamy fine sand

*Subsurface layer:*  
 2 to 4 inches—grayish brown loamy fine sand

*Subsoil:*  
 4 to 7 inches—strong brown, very friable loamy fine sand  
 7 to 24 inches—yellowish brown, very friable loamy fine sand  
 24 to 80 inches—yellowish brown, very friable fine sand with thin bands of strong brown loamy fine sand

### **Soil Properties and Qualities**

*Permeability:* Rapid  
*Available water capacity:* Low  
*Drainage class:* Excessively drained  
*Seasonal high water table:* At a depth of more than 6 feet  
*Surface runoff:* Very slow  
*Flooding:* None  
*Hazard of water erosion:* Slight  
*Hazard of soil blowing:* Moderate  
*Shrink-swell potential:* Low  
*Potential for frost action:* Low

### **Composition**

Zimmerman soil and similar soils: 90 to 100 percent  
 Contrasting inclusions: 0 to 10 percent

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained Croswell soils

*Similar inclusions:*

- Soils that are medium sand

### **Use and Management**

*Land use:* Woodland

### **Woodland**

*Major management concerns:* Seedling mortality, seasonal droughtiness, equipment limitations

*Management considerations:*

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

**Building sites***Major management concerns:* Cutbanks caving*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

**Septic tank absorption fields***Major management concerns:* Rapid permeability*Management considerations:*

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

**Interpretive Groups***Land capability classification:* IVs*Woodland ordination symbol:* 8S*Michigan soil management group:* 4a**86—Histosols and Aquepts, ponded****Setting***Landform:* Depressions on lake plains, outwash plains, till plains, moraines, and flood plains*Slope range:* 0 to 2 percent*Shape of areas:* Oval, linear, or irregular*Size of areas:* 3 to 100 acres**Typical Profile****Histosols***Surface layer:*

0 to 10 inches—black muck

*Subsoil:*

10 to 51 inches—very dark gray, friable muck

*Substratum:*

51 to 80 inches—gray sandy loam

**Aquepts***Surface layer:*

0 to 3 inches—black muck

*Subsoil:*

3 to 20 inches—gray, loose sand

*Substratum:*

20 to 80 inches—light brownish gray sand

**Soil Properties and Qualities***Permeability:* Moderately rapid to moderately slow*Available water capacity:* Histosols—high; Aquepts—low*Drainage class:* Very poorly drained*Seasonal high water table:* Apparent, at the surface to 1 foot above the surface at some time from January through December*Surface runoff:* Ponded*Flooding:* None*Hazard of water erosion:* Slight*Hazard of soil blowing:* Histosols—moderate; Aquepts—not evaluated*Shrink-swell potential:* Not evaluated*Potential for frost action:* High**Composition**

Aquepts: 0 to 100 percent

Histosols: 0 to 100 percent

Contrasting inclusions: 0 to 5 percent

**Contrasting Inclusions**

- Soils that are poorly drained or somewhat poorly drained

**Use and Management***Land use:* Wetland wildlife habitat*Management considerations:*

- Onsite investigation is needed to determine the suitability for specific uses.

**Interpretive Groups***Land capability classification:* None assigned*Woodland ordination symbol:* None assigned*Michigan soil management group:* None assigned**93B—Tacoda-Wakeley complex, 0 to 4 percent slopes****Setting***Landform:* Lake plains*Slope range:* Tacoda—0 to 4 percent; Wakeley—0 to 2 percent*Shape of areas:* Irregular*Size of areas:* 10 to 50 acres

### Typical Profile

#### Tacoda

*Surface layer:*

0 to 3 inches—black sand

*Subsurface layer*

3 to 15 inches—light gray, mottled sand

*Subsoil:*

15 to 23 inches—dark brown, mottled, friable sand  
 23 to 35 inches—very pale brown and light yellowish brown, mottled, loose sand  
 35 to 45 inches—brown, mottled, loose sand

*Substratum:*

45 to 60 inches—dark brown silty clay  
 60 to 80 inches—brown, mottled silty clay

#### Wakeley

*Surface layer:*

0 to 5 inches—black muck

*Substratum:*

5 to 16 inches—dark grayish brown and grayish brown, mottled sand  
 16 to 27 inches—brown, mottled sand  
 27 to 80 inches—reddish brown and pinkish gray, mottled clay

### Soil Properties and Qualities

*Permeability:* Rapid in the sandy part and very slow in the clayey part

*Available water capacity:* Tacoda—low; Wakeley—moderate

*Drainage class:* Tacoda—somewhat poorly drained; Wakeley—very poorly drained

*Seasonal high water table:* Tacoda—perched at a depth of 0.5 foot to 1.5 feet at some time from October through May; Wakeley—perched 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Tacoda—very slow; Wakeley—very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Tacoda—severe; Wakeley—moderate

*Shrink-swell potential:* Tacoda—low; Wakeley—high

*Potential for frost action:* Moderate

### Composition

Tacoda soil and similar soils: 50 to 60 percent  
 Wakeley soil and similar soils: 40 to 50 percent  
 Contrasting inclusions: 5 to 10 percent

### Inclusions

*Contrasting inclusions:*

- The very poorly drained, sandy Leafriver soils

*Similar inclusions:*

- Soils that have thinner sandy layers

### Use and Management

*Dominant land use:* Woodland

*Other use:* Pasture

#### Pasture

*Major management concerns:* Tacoda—seasonal wetness, seasonal droughtiness; Wakeley—seasonal wetness

*Management considerations:*

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants.

#### Woodland

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition, seedling mortality, seasonal wetness

*Management considerations:*

- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Wakeley soil.

#### Building sites

*Major management concerns:* Tacoda—cutbanks

caving, seasonal wetness, shrink-swell; Wakeley—ponding

*Management considerations:*

- Because cutbanks in areas of the Tacoda soil are not stable and are subject to caving, trench walls should be reinforced.
- In areas of the Tacoda soil, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- In areas of the Tacoda soil, properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Because of ponding, the Wakeley soil is generally unsuited to building site development.

**Septic tank absorption fields**

*Major management concerns:* Tacoda—rapid permeability, restricted permeability, seasonal wetness; Wakeley—ponding

*Management considerations:*

- The poor filtering capacity of the Tacoda soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability in areas of the Tacoda soil.
- In areas of the Tacoda soil, filling or mounding with suitable material helps to raise the absorption field above the water table.
- Because of ponding, the Wakeley soil is generally unsuited to septic tank absorption fields.

**Interpretive Groups**

*Land capability classification:* IVw

*Woodland ordination symbol:* Tacoda—4W; Wakeley—3W

*Michigan soil management group:* Tacoda—5b; Wakeley—4/1c

**97—Colonville very fine sandy loam, occasionally flooded**

**Setting**

*Landform:* Flood plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Linear

*Size of areas:* 10 to 100 acres

**Typical Profile**

*Surface layer:*

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

6 to 11 inches—very dark grayish brown, mottled very fine sandy loam

*Subsoil:*

11 to 16 inches—brown, mottled very fine sandy loam

*Substratum:*

16 to 80 inches—pale brown, mottled, stratified fine sand, silt loam, and very fine sandy loam

**Soil Properties and Qualities**

*Permeability:* Moderate

*Available water capacity:* High

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* Occasional

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* High

**Composition**

Colonville soil and similar soils: 85 to 90 percent

Contrasting inclusions: 10 to 15 percent

**Inclusions**

*Contrasting inclusions:*

- The very poorly drained, sandy Rollaway soils
- The very poorly drained, mucky over sandy Tawas soils

*Similar inclusions:*

- Soils that have a surface layer of mucky very fine sandy loam
- Soils that have a thinner surface layer

**Use and Management**

*Land use:* Woodland

**Woodland**

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.

- Skidders should not be used during wet periods, when ruts form easily.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Trees that can withstand seasonal wetness should be selected for planting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

### **Building sites**

*Major management concerns:* Seasonal flooding

*Management considerations:*

- Because of flooding, this soil is generally unsuited to building site development.

### **Septic tank absorption fields**

*Major management concerns:* Seasonal flooding

*Management considerations:*

- Because of flooding, this soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* 3W

*Michigan soil management group:* L-2c

## **100D—Curtisville sandy loam, 12 to 18 percent slopes**

### **Setting**

*Landform:* Moraines and till plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 100 acres

### **Typical Profile**

*Surface layer:*

0 to 5 inches—very dark grayish brown sandy loam

*Subsoil:*

5 to 10 inches—light brownish gray, friable sandy loam and dark yellowish brown, friable sandy loam

10 to 16 inches—brown, firm clay loam and brown, firm sandy loam

16 to 29 inches—reddish brown, firm clay

*Substratum:*

29 to 80 inches—reddish brown and brown clay loam

### **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* Moderate

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Moderate

*Potential for frost action:* Moderate

### **Composition**

Curtisville soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The well drained, sandy over loamy Menominee soils
- The somewhat poorly drained Kawkawlin soils
- The poorly drained Sims soils

*Similar inclusions:*

- Soils that have more clay in the subsoil
- Soils that have a surface layer of clay loam
- Soils that have a sandy substratum

### **Use and Management**

*Dominant land use:* Pasture

*Other uses:* Cropland, woodland

### **Cropland**

*Major management concerns:* Water erosion, soil blowing, soil compaction, tillth in the surface layer, restricted permeability, nutrient and pesticide loss

*Management considerations:*

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tillth.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Conservation tillage systems, contour farming, cover

crops, and sod-based rotations can minimize the detachment and loss of nutrients associated with sediment and thus help to prevent the loss of solid-phase nitrogen and phosphorus.

### **Pasture**

*Major management concerns:* Soil compaction

*Management considerations:*

- Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests can help to ensure the maximum growth of plants, especially legumes.

### **Woodland**

*Major management concerns:* Plant competition, equipment limitations, slope

*Management considerations:*

- The grade should be kept as low as possible.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Special harvest methods may be needed to control undesirable plants.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

### **Building sites**

*Major management concerns:* Slope, shrink-swell

*Management considerations:*

- Because of the slope, this soil is poorly suited to building site development unless extensive land shaping is feasible.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

### **Septic tank absorption fields**

*Major management concerns:* Restricted permeability, slope

*Management considerations:*

- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

### **Interpretive Groups**

*Land capability classification:* IVe

*Woodland ordination symbol:* 3L

*Michigan soil management group:* 1.5a

## **100E—Curtisville sandy loam, 18 to 25 percent slopes**

### **Setting**

*Landform:* Moraines and till plains

*Shape of areas:* Linear

*Size of areas:* 5 to 50 acres

### **Typical Profile**

*Surface layer:*

0 to 5 inches—very dark grayish brown sandy loam

*Subsoil:*

5 to 10 inches—light brownish gray, friable sandy loam and dark yellowish brown, friable sandy loam

10 to 16 inches—brown, firm clay loam and brown, firm sandy loam

16 to 29 inches—reddish brown, firm clay

*Substratum:*

29 to 80 inches—reddish brown and brown clay loam

### **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* Moderate

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Moderate

*Potential for frost action:* Moderate

### **Composition**

Curtisville soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The well drained, sandy over loamy Menominee soils
- The somewhat poorly drained Kawkawlin soils

*Similar inclusions:*

- Soils that have more clay in the subsoil
- Soils that have a surface layer of clay loam
- Soils that have a sandy substratum

### **Use and Management**

*Dominant land use:* Woodland

*Other use:* Pasture

### **Pasture**

*Major management concerns:* Compaction

*Management considerations:*

- Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests can help to ensure the maximum growth of plants, especially legumes.

### **Woodland**

*Major management concerns:* Erosion hazard, equipment limitations, plant competition, slope

*Management considerations:*

- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The grade should be kept as low as possible.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Special harvest methods may be needed to control undesirable plants.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

### **Building sites**

*Major management concerns:* Slope

*Management considerations:*

- Because of the slope, this soil is poorly suited to building site development unless extensive land shaping is feasible.

### **Septic tank absorption fields**

*Major management concerns:* Slope

*Management considerations:*

- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* VIe

*Woodland ordination symbol:* 3R

*Michigan soil management group:* 1.5a

## **103B—Nester sandy loam, 1 to 6 percent slopes**

### **Setting**

*Landform:* Moraines and till plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 500 acres

### **Typical Profile**

*Surface layer:*

0 to 11 inches—very dark grayish brown sandy loam

*Subsoil:*

11 to 17 inches—light grayish brown, friable sandy loam and dark brown, friable clay loam

17 to 34 inches—brown, firm clay loam

*Substratum:*

34 to 50 inches—strong brown, mottled clay loam

50 to 80 inches—brown clay loam

### **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* Moderate

*Drainage class:* Moderately well drained

*Seasonal high water table:* Perched at a depth of 2.5 to 3.5 feet at some time from November through May

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Moderate

*Potential for frost action:* Moderate

### **Composition**

Nester soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Kawkawlin soils
- The moderately well drained, sandy over loamy Morganlake soils
- The poorly drained Sims soils

*Similar inclusions:*

- Soils that have more clay in the subsoil
- Soils that have less clay in the subsoil
- Soils that have a surface layer of loamy sand
- Soils that have sandy layers below a depth of 60 inches

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Woodland, pasture

#### **Cropland**

*Major management concerns:* Water erosion, soil blowing, soil compaction, tilling in the surface layer, restricted permeability, seasonal wetness

*Management considerations:*

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilling.

#### **Pasture**

*Major management concerns:* Soil compaction, seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilling.

#### **Woodland**

*Major management concerns:* Plant competition, equipment limitations, seasonal wetness

*Management considerations:*

- Skidders should not be used during wet periods, when ruts form easily.
- Special harvest methods may be needed to control undesirable plants.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

#### **Building sites**

*Major management concerns:* Shrink-swell

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

#### **Septic tank absorption fields**

*Major management concerns:* Restricted permeability, seasonal wetness

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IIe

*Woodland ordination symbol:* 3L

*Michigan soil management group:* 1.5a

## **103C—Nester sandy loam, 6 to 12 percent slopes**

### **Setting**

*Landform:* Moraines and till plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 200 acres

### **Typical Profile**

*Surface layer:*

0 to 11 inches—very dark grayish brown sandy loam

*Subsoil:*

11 to 17 inches—light grayish brown, friable sandy loam and dark brown, friable clay loam

17 to 34 inches—brown, firm clay loam

*Substratum:*

34 to 50 inches—strong brown, mottled clay loam

50 to 80 inches—brown clay loam

### **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* Moderate

*Drainage class:* Moderately well drained

*Seasonal high water table:* Perched at a depth of 2.5 to 3.5 feet at some time from November through May

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Moderate

*Potential for frost action:* Moderate

### **Composition**

Nester soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### ***Inclusions***

#### *Contrasting inclusions:*

- The moderately well drained, sandy over loamy Morganlake soils
- The poorly drained Sims soils

#### *Similar inclusions:*

- Soils that have more clay in the subsoil
- Soils that have a surface layer of clay loam
- Soils that have sandy layers below a depth of 60 inches

### ***Use and Management***

*Dominant land use:* Cropland

*Other uses:* Woodland, pasture

#### **Cropland**

*Major management concerns:* Water erosion, soil blowing, soil compaction, tilth in the surface layer, restricted permeability, seasonal wetness

#### *Management considerations:*

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

#### **Pasture**

*Major management concerns:* Soil compaction, seasonal wetness

#### *Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

#### **Woodland**

*Major management concerns:* Plant competition, equipment limitations, seasonal wetness

#### *Management considerations:*

- Skidders should not be used during wet periods, when ruts form easily.
- Special harvest methods may be needed to control undesirable plants.
- If trees are planted, site preparation by mechanical

or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

#### **Building sites**

*Major management concerns:* Slope, shrink-swell

#### *Management considerations:*

- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

#### **Septic tank absorption fields**

*Major management concerns:* Restricted permeability, seasonal wetness, slope

#### *Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

### ***Interpretive Groups***

*Land capability classification:* IIIe

*Woodland ordination symbol:* 3L

*Michigan soil management group:* 1.5a

## **108B—Selkirk loam, 0 to 4 percent slopes**

### ***Setting***

*Landform:* Till plains and moraines

*Shape of areas:* Irregular

*Size of areas:* 3 to 200 acres

### ***Typical Profile***

*Surface layer:*

0 to 9 inches—dark brown loam

*Subsoil:*

9 to 15 inches—yellowish brown, mottled, friable loam and pale brown, mottled, friable sandy loam

15 to 28 inches—dark brown and brown, mottled, firm clay

*Substratum:*

28 to 80 inches—light yellowish brown and brown, mottled clay

## **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* Moderate

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Perched at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* High

*Potential for frost action:* High

### **Composition**

Selkirk soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The poorly drained Sims soils
- The moderately well drained Kent soils
- The somewhat poorly drained, sandy over clayey Allendale soils; in landscape positions similar to those of the Selkirk soil

*Similar inclusions:*

- Soils that have a sandy substratum
- Soils that have less clay in the subsoil
- Soils that have a surface layer of clay loam

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

#### **Cropland**

*Major management concerns:* Seasonal wetness, tilth in the surface layer, soil compaction, restricted permeability

*Management considerations:*

- Most adapted crops can be grown if an adequate drainage system is installed.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Crop rotations that include grasses and legumes and small grain help to control runoff and water erosion.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.

#### **Pasture**

*Major management concerns:* Seasonal wetness, compaction

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

#### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seedling mortality, windthrow hazard, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, and midwinter, when the soil is frozen or has adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Special harvest methods may be needed to control undesirable plants.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

#### **Building sites**

*Major management concerns:* Seasonal wetness, shrink-swell

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

#### **Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, restricted permeability

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.

- A subsurface drainage system helps to lower the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IIIe

*Woodland ordination symbol:* 4C

*Michigan soil management group:* 1b

## **114A—Ingalls sand, 0 to 3 percent slopes**

### **Setting**

*Landform:* Lake plains and outwash plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 100 acres

### **Typical Profile**

*Surface layer:*

0 to 9 inches—black sand

*Subsurface layer:*

9 to 12 inches—light gray sand

*Subsoil:*

12 to 16 inches—dark brown, mottled, very friable sand

16 to 27 inches—pale brown, mottled, friable fine sand

*Substratum:*

27 to 42 inches—pale brown, light gray, and light reddish brown, stratified sand, very fine sand, and silt

42 to 80 inches—brown, strong brown, and pale brown, stratified fine sand, fine sandy loam, silty clay loam, and silt

### **Soil Properties and Qualities**

*Permeability:* Rapid in the sandy part and moderately slow in the stratified part

*Available water capacity:* Moderate

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Perched at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

### **Composition**

Ingalls soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Wakeley soils

*Similar inclusions:*

- Soils that have a lighter colored subsoil

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

#### **Cropland**

*Major management concerns:* Soil blowing, seasonal wetness

*Management considerations:*

- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.
- Most adapted crops can be grown if an adequate drainage system is installed.
- Subsurface drains can reduce the wetness if a suitable outlet is available.

#### **Pasture**

*Major management concerns:* Seasonal wetness, overgrazing

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced

and by such harvest methods as selective cutting and strip cutting.

- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

### **Building sites**

*Major management concerns:* Cutbanks caving, seasonal wetness

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

### **Septic tank absorption fields**

*Major management concerns:* Rapid permeability, restricted permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IIIw

*Woodland ordination symbol:* 4W

*Michigan soil management group:* 4/2b-s

## **120B—Morganlake sand, 0 to 6 percent slopes**

### **Setting**

*Landform:* Moraines and till plains

*Shape of areas:* Irregular

*Size of areas:* 3 to 200 acres

### **Typical Profile**

*Surface layer:*

0 to 4 inches—black sand

*Subsurface layer:*

4 to 6 inches—light brownish gray sand

*Subsoil:*

6 to 13 inches—dark brown, friable sand

13 to 23 inches—brown, very friable sand

23 to 29 inches—light brownish gray, mottled, very friable loamy sand

29 to 47 inches—dark brown, mottled firm clay loam and pinkish gray, very friable sandy loam

*Substratum:*

47 to 80 inches—reddish brown, mottled clay loam

### **Soil Properties and Qualities**

*Permeability:* Rapid in the sandy part and moderately slow in the loamy part

*Available water capacity:* Moderate

*Drainage class:* Moderately well drained

*Seasonal high water table:* Perched at a depth of 2.0 to 3.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Moderate

*Potential for frost action:* Low

### **Composition**

Morganlake soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained, loamy Nester soils
- The somewhat poorly drained Kokosing soils

*Similar inclusions:*

- Soils that have a lighter colored subsoil
- Soils that have a loamy substratum at a depth of more than 40 inches

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

### **Cropland**

*Major management concerns:* Soil blowing, seasonal droughtiness

**Management considerations:**

- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. Maintaining a permanent plant cover also helps to control soil blowing.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.

**Pasture**

*Major management concerns:* Overgrazing, seasonal droughtiness

*Management considerations:*

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests can help to ensure the maximum growth of plants, especially legumes.

**Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, plant competition, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate. Replanting is needed in some areas.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

**Building sites**

*Major management concerns:* Cutbanks caving, seasonal wetness, shrink-swell

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill

material, which raises the site a sufficient distance above the water table.

- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Major management concerns:* Rapid permeability, restricted permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

**Interpretive Groups**

*Land capability classification:* IIIs

*Woodland ordination symbol:* 6S

*Michigan soil management group:* 4/2a

**120C—Morganlake sand, 6 to 12 percent slopes****Setting**

*Landform:* Moraines and till plains

*Shape of areas:* Irregular

*Size of areas:* 3 to 200 acres

**Typical Profile**

*Surface layer:*

0 to 4 inches—black sand

*Subsurface layer:*

4 to 6 inches—light brownish gray sand

*Subsoil:*

6 to 13 inches—dark brown, friable sand

13 to 23 inches—brown, very friable sand

23 to 29 inches—light brownish gray, mottled, very friable loamy sand

29 to 47 inches—dark brown, mottled, firm clay loam and pinkish gray, very friable sandy loam

*Substratum:*

47 to 80 inches—reddish brown, mottled clay loam

### **Soil Properties and Qualities**

*Permeability:* Rapid in the sandy part and moderately slow in the loamy part

*Available water capacity:* Moderate

*Drainage class:* Moderately well drained

*Seasonal high water table:* Perched at a depth of 2.0 to 3.5 feet at some time from October through May

*Surface runoff:* Slow

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Moderate

*Potential for frost action:* Low

### **Composition**

Morganlake soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained, loamy Nester soils
- The somewhat poorly drained Kokosing soils

*Similar inclusions:*

- Well drained soils in the steeper areas
- Soils that have a clayey substratum
- Soils that have a lighter colored subsoil
- Soils that have a loamy substratum at a depth of more than 40 inches

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

#### **Cropland**

*Major management concerns:* Soil blowing, water erosion, seasonal droughtiness

*Management considerations:*

- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. Maintaining a permanent plant cover also helps to control soil blowing.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Crop rotations that include grasses or legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
- Growing grasses and legumes for pasture or hay is effective in controlling erosion.

#### **Pasture**

*Major management concerns:* Overgrazing, seasonal droughtiness

*Management considerations:*

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests can help to ensure the maximum growth of plants, especially legumes.

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, plant competition, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings can reduce the seedling mortality rate. Planting seedlings that can withstand droughty conditions can also reduce the seedling mortality rate. Replanting is needed in some areas.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

#### **Building sites**

*Major management concerns:* Cutbanks caving, slope, seasonal wetness, shrink-swell

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Filling or mounding with suitable material helps to raise the building site above the water table.

#### **Septic tank absorption fields**

*Major management concerns:* Rapid permeability, restricted permeability, slope, seasonal wetness

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.

- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

### **Interpretive Groups**

*Land capability classification:* IIIs  
*Woodland ordination symbol:* 6S  
*Michigan soil management group:* 4/2a

## **123D—Klacking sand, 6 to 18 percent slopes**

### **Setting**

*Landform:* Moraines and outwash plains  
*Shape of areas:* Irregular  
*Size of areas:* 20 acres

### **Typical Profile**

*Surface layer:*  
 0 to 2 inches—black sand

*Subsoil:*  
 2 to 34 inches—yellowish brown and dark yellowish brown, friable sand  
 34 to 44 inches—yellowish brown, friable sand and strong brown, friable loamy sand  
 44 to 80 inches—strong brown, friable sandy loam and light yellowish brown, friable sand

### **Soil Properties and Qualities**

*Permeability:* Moderately rapid  
*Available water capacity:* Moderate  
*Drainage class:* Well drained  
*Seasonal high water table:* At a depth of more than 6 feet  
*Surface runoff:* Medium  
*Flooding:* None  
*Hazard of water erosion:* Severe  
*Hazard of soil blowing:* Severe  
*Shrink-swell potential:* Low  
*Potential for frost action:* Low

### **Composition**

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

### **Inclusions**

#### *Contrasting inclusions:*

- The excessively drained Rubicon soils

#### *Similar inclusions:*

- Soils that have less than 6 inches of banding in the subsoil

### **Use and Management**

*Land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, slope, seasonal droughtiness

#### *Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- The grade should be kept as low as possible.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting seedlings that can withstand droughty conditions can also reduce the seedling mortality rate. Replanting is needed in some areas.

#### **Building sites**

*Major management concerns:* Slope, cutbanks caving

#### *Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Because of the slope, this soil is poorly suited to building site development unless extensive land shaping is feasible.

#### **Septic tank absorption fields**

*Major management concerns:* Slope

#### *Management considerations:*

- Land shaping and installing the distribution lines on the contour help to overcome the slope.

### **Interpretive Groups**

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

## **124—Evert sand**

### **Setting**

*Landform:* Flood plains  
*Slope range:* 0 to 2 percent  
*Shape of areas:* Linear  
*Size of areas:* 5 to 10 acres

### **Typical Profile**

#### *Surface layer:*

0 to 10 inches—black sand

10 to 14 inches—very dark gray, mottled sand

#### *Substratum:*

14 to 22 inches—grayish brown sand

22 to 25 inches—dark grayish brown gravelly sand

25 to 36 inches—brown, mottled sand

36 to 80 inches—grayish brown, mottled sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from January through December

*Surface runoff:* Very slow or ponded

*Flooding:* Common

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

### **Composition**

Evart soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

#### *Contrasting inclusions:*

- The very poorly drained Tawas soils

#### *Similar inclusions:*

- Soils that are somewhat poorly drained

### **Use and Management**

*Land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal wetness

#### *Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

#### **Building sites**

*Major management concerns:* Seasonal flooding

#### *Management considerations:*

- Because of flooding, this soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Seasonal flooding

#### *Management considerations:*

- Because of flooding, this soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* VIIw

*Woodland ordination symbol:* 2w

*Michigan soil management group:* L-4c

## **127—Cathro muck**

### **Setting**

*Landform:* Depressions on moraines, lake plains, and outwash plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 5 to 25 acres

### **Typical Profile**

#### *Surface layer:*

0 to 5 inches—black muck

#### *Substratum:*

5 to 30 inches—black muck

30 to 80 inches—dark gray sandy loam

### **Soil Properties and Qualities**

*Permeability:* Moderately slow to moderately rapid in the organic part and moderately slow or moderate in the loamy part

*Available water capacity:* High

*Drainage class:* Very poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* High

### **Composition**

Cathro soil and similar soils: 90 to 100 percent  
Contrasting inclusions: 0 to 10 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Deford soils, which have less than 8 inches of muck at the surface and are sandy

*Similar inclusions:*

- Soils that have a sandy substratum

### **Use and Management**

*Land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, plant competition, windthrow, seasonal wetness

*Management considerations:*

- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Selective cutting or cutting in strips and leaving desirable seed trees along the edge of the openings are beneficial for natural regeneration.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

#### **Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* Vlw

*Woodland ordination symbol:* 5W

*Michigan soil management group:* M/3c

## **128—Dawson peat**

### **Setting**

*Landform:* Depressions on lake plains, moraines, and outwash plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Oval

*Size of areas:* 3 to 100 acres

### **Typical Profile**

*Surface layer:*

0 to 3 inches—dark brown peat

*Subsoil:*

3 to 18 inches—black, friable muck

18 to 27 inches—very dark gray, friable muck

*Substratum:*

27 to 45 inches—dark brown sand

45 to 80 inches—dark yellowish brown sand

### **Soil Properties and Qualities**

*Permeability:* Moderately slow to moderately rapid in the organic part and rapid in the sandy part

*Available water capacity:* High

*Drainage class:* Very poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from September through June

*Surface runoff:* Ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* Low

*Potential for frost action:* High

### **Composition**

Dawson soil and similar soils: 90 to 95 percent

Contrasting inclusions: 5 to 10 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Deford soils, which have less than 8 inches of muck at the surface

*Similar inclusions:*

- Soils that are less acid throughout the profile
- Soils that have more than 51 inches of muck

### **Use and Management**

*Land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations,

plant competition, seasonal wetness, seedling mortality, windthrow hazard

*Management considerations:*

- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

**Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

**Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

**Interpretive Groups**

*Land capability classification:* VIIw

*Woodland ordination symbol:* 2W

*Michigan soil management group:* M/4c-a

**130—Grousehaven muck**

**Setting**

*Landform:* Lake plains, outwash plains, and moraines

*Slope range:* 0 to 1 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 80 acres

**Typical Profile**

*Surface layer:*

0 to 12 inches—black muck

*Substratum:*

12 to 80 inches—pinkish white, white, and gray marl

**Soil Properties and Qualities**

*Permeability:* Moderately slow to moderately rapid in the organic part and very slow in the marl

*Available water capacity:* Very high

*Drainage class:* Very poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* High

**Composition**

Grousehaven soil and similar soils: 90 to 100 percent

Contrasting inclusions: 0 to 10 percent

**Inclusions**

*Contrasting inclusions:*

- The very poorly drained Deford soils, which have less than 8 inches of muck at the surface and are sandy
- Small areas of tufa

*Similar inclusions:*

- Soils that do not have a surface layer of muck
- Soils in which the marl in the substratum is stratified with sand or gravelly sand
- Soils that have more than 16 inches of muck

**Use and Management**

*Land use:* Woodland

**Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition

*Management considerations:*

- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

**Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

**Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

**Interpretive Groups**

*Land capability classification:* VIIw

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* M/mc

**159A—Finch sand, 0 to 3 percent slopes****Setting**

*Landform:* Lake plains and outwash plains

*Shape of areas:* Irregular or linear

*Size of areas:* 5 to 100 acres

**Typical Profile**

*Surface layer:*

0 to 3 inches—black, well decomposed leaf litter

*Subsurface layer:*

3 to 12 inches—gray and light brownish gray, mottled sand

*Subsoil:*

12 to 21 inches—dark reddish brown and black, strongly cemented, very firm sand

21 to 28 inches—yellowish brown, mottled, loose sand

*Substratum:*

28 to 36 inches—yellowish brown, mottled sand

36 to 80 inches—brown sand

**Soil Properties and Qualities**

*Permeability:* Moderately rapid

*Available water capacity:* Low

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

**Composition**

Finch soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

**Inclusions**

*Contrasting inclusions:*

- The moderately well drained Proper soils
- The very poorly drained Deford and Leafriver soils

*Similar inclusions:*

- Soils that have a lighter colored subsoil
- Soils that do not have a cemented subsoil
- Soils that have clay material below a depth of 40 inches

**Use and Management**

*Land use:* Woodland

**Woodland**

*Major management concerns:* Equipment limitations, plant competition, seedling mortality, windthrow hazard, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Planting when the soil is moist can reduce the seedling mortality rate.

**Building sites**

*Major management concerns:* Cutbanks caving, seasonal wetness

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

**Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, moderately rapid permeability

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.

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

### **Interpretive Groups**

*Land capability classification:* IVw  
*Woodland ordination symbol:* 4W  
*Michigan soil management group:* 5b-h

## **182—Pits, quarry**

### **Setting**

*Landform:* Lake plains  
*Shape of areas:* Irregular  
*Size of areas:* 10 to 200 acres

### **Composition**

Pits: 100 percent

### **Use and Management**

*Land use:* Source of gypsum  
*Management considerations:*

- Onsite investigation is needed to determine the suitability for specific uses.

### **Interpretive Groups**

*Land capability classification:* None assigned  
*Woodland ordination symbol:* None assigned  
*Michigan soil management group:* None assigned

## **197A—Gladwin loamy sand, 0 to 3 percent slopes**

### **Setting**

*Landform:* Outwash plains  
*Shape of areas:* Irregular  
*Size of areas:* 5 to 20 acres

### **Typical Profile**

*Surface layer:*  
 0 to 2 inches—black loamy sand

*Subsurface layer:*  
 2 to 7 inches—light brownish gray sand

*Subsoil:*  
 7 to 10 inches—dark brown, very friable sand  
 10 to 16 inches—yellowish brown, mottled, very friable sand

16 to 22 inches—light yellowish brown, mottled, very friable sand  
 22 to 26 inches—dark yellowish brown, mottled, friable very gravelly sandy loam

### *Substratum:*

26 to 30 inches—yellowish brown, mottled very gravelly sand  
 30 to 80 inches—light brownish gray very gravelly sand

### **Soil Properties and Qualities**

*Permeability:* Rapid  
*Available water capacity:* Low  
*Drainage class:* Somewhat poorly drained  
*Seasonal high water table:* Apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May  
*Surface runoff:* Slow  
*Flooding:* None  
*Hazard of water erosion:* Slight  
*Hazard of soil blowing:* Moderate  
*Shrink-swell potential:* Low  
*Potential for frost action:* Moderate

### **Composition**

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

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Deford soils

*Similar inclusions:*

- Soils that have less gravel in the substratum
- Soils that have a surface layer of sand

### **Use and Management**

*Land use:* Woodland

### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seasonal wetness, seedling mortality, windthrow hazard

### *Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Trees that can withstand seasonal wetness should be selected for planting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

### **Building sites**

*Major management concerns:* Cutbanks caving, seasonal wetness

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

### **Septic tank absorption fields**

*Major management concerns:* Rapid permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

### **Interpretive Groups**

*Land capability classification:* IIIw

*Woodland ordination symbol:* 5W

*Michigan soil management group:* 4b

## **209B—Grayling sand, calcareous substratum, nearly level and undulating**

### **Setting**

*Landform:* Deltas and river terraces

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 50 to 2,000 acres

### **Typical Profile**

*Surface layer:*

0 to 2 inches—black sand

*Subsoil:*

2 to 4 inches—dark yellowish brown, very friable sand

4 to 29 inches—yellowish brown, loose sand

*Substratum:*

29 to 70 inches—light yellowish brown sand

70 to 180 inches—yellowish brown, calcareous sand that has strata of fine sand, coarse sand, or gravelly sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### **Composition**

Grayling soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils
- The very poorly drained, dysic Borosapristis

*Similar inclusions:*

- Sandy soils that have a banded substratum
- Sandy soils that have a gray subsurface layer
- Sandy soils that are moderately well drained

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

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

### **Interpretive Groups**

*Land capability classification:* VI<sub>s</sub>

*Woodland ordination symbol:* 4S

*Michigan soil management group:* 5.7a

*Primary plant association:* Black oak-White oak-Blueberry

*Secondary plant association:* Mixed oak-Red maple-Starflower

## 209C—Grayling sand, calcareous substratum, rolling

### Setting

*Landform:* Deltas and river terraces

*Slope range:* 6 to 18 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 200 acres

### Typical Profile

*Surface layer:*

0 to 2 inches—black sand

*Subsoil:*

2 to 4 inches—dark yellowish brown, very friable sand

4 to 29 inches—yellowish brown, loose sand

*Substratum:*

29 to 70 inches—light yellowish brown sand

70 to 180 inches—yellowish brown, calcareous sand that has strata of fine sand, coarse sand, or gravelly sand

### Soil Properties and Qualities

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### Composition

Grayling soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

### Inclusions

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils in slight depressions
- The very poorly drained, dysic Borosapristis in depressions

*Similar inclusions:*

- Sandy soils that have a banded substratum
- Sandy soils that have a gray subsurface layer
- Sandy soils that are moderately well drained

### Use and Management

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

### Interpretive Groups

*Land capability classification:* VIIs

*Woodland ordination symbol:* 4S

*Michigan soil management group:* 5.7a

*Primary plant association:* Black oak-White oak-Blueberry

*Secondary plant association:* Mixed oak-Red maple-Starflower

## 209D—Grayling sand, calcareous substratum, hilly

### Setting

*Landform:* Deltas and river terraces

*Slope range:* 18 to 30 percent

*Shape of areas:* Linear

*Size of areas:* 10 to 200 acres

### Typical Profile

*Surface layer:*

0 to 2 inches—black sand

*Subsoil:*

2 to 4 inches—dark yellowish brown, very friable sand

4 to 29 inches—yellowish brown, loose sand

*Substratum:*

29 to 70 inches—light yellowish brown sand

70 to 180 inches—yellowish brown, calcareous sand that has strata of fine sand, coarse sand, or gravelly sand

### Soil Properties and Qualities

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### **Composition**

Grayling soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

### **Inclusions**

*Contrasting inclusions:*

- Haplorthods and Eutroboralfs in landscape positions similar to those of the Grayling soil

*Similar inclusions:*

- Sandy soils that have a banded substratum
- Sandy soils that have a gray subsurface layer
- Sandy soils that are moderately well drained

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, erosion hazard, slope, seasonal droughtiness

*Management considerations:*

- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The grade should be kept as low as possible.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

### **Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* 4R

*Michigan soil management group:* 5.7a

*Primary plant association:* Black oak-White oak-Blueberry

*Secondary plant association:* Mixed oak-Red maple-Starflower

## **210B—Grayling sand, nearly level and undulating**

### **Setting**

*Landform:* Outwash plains

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 80 to 600 acres

### **Typical Profile**

*Surface layer:*

0 to 2 inches—black sand

*Subsoil:*

2 to 4 inches—dark yellowish brown, very friable sand

4 to 29 inches—yellowish brown, loose sand

*Substratum:*

29 to 180 inches—light yellowish brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### **Composition**

Grayling 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 very poorly drained, dysic Borosaprists; in depressions

*Similar inclusions:*

- Sandy soils that have a banded substratum
- Sandy soils that have a gray subsurface layer
- Sandy soils that are moderately well drained

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.

- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

### **Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* 4S

*Michigan soil management group:* 5.7a

*Primary plant association:* Black oak-White oak-Blueberry

*Secondary plant association:* Mixed oak-Red maple-Starflower

## **210C—Grayling sand, rolling**

### **Setting**

*Landform:* Outwash plains and deltas

*Slope range:* 6 to 18 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 400 acres

### **Typical Profile**

*Surface layer:*

0 to 2 inches—black sand

*Subsoil:*

2 to 4 inches—dark yellowish brown, very friable sand

4 to 29 inches—yellowish brown, loose sand

*Substratum:*

29 to 180 inches—light yellowish brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### **Composition**

Grayling soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

### **Inclusions**

*Contrasting inclusions:*

- The more fertile, sandy Alfic Haplorthods and sandy Entic Haplorthods that have a loamy substratum; in

landscape positions similar to those of the Grayling soil

*Similar inclusions:*

- Sandy soils that have a banded substratum
- Sandy soils that have a gray subsurface layer
- Sandy soils that are moderately well drained

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

### **Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* 4S

*Michigan soil management group:* 5.7a

*Primary plant association:* Black oak-White oak-Blueberry

*Secondary plant association:* Mixed oak-Red maple-Starflower

## **210D—Grayling sand, hilly**

### **Setting**

*Landform:* Deltas

*Slope range:* 18 to 30 percent

*Shape of areas:* Linear

*Size of areas:* 20 to 100 acres

### **Typical Profile**

*Surface layer:*

0 to 2 inches—black sand

*Subsoil:*

2 to 4 inches—dark yellowish brown, very friable sand

4 to 29 inches—yellowish brown, loose sand

*Substratum:*

29 to 180 inches—light yellowish brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained  
*Seasonal high water table:* At a depth of more than 15 feet  
*Surface runoff:* Rapid  
*Flooding:* None  
*Hazard of water erosion:* Moderate  
*Hazard of soil blowing:* Severe  
*Potential for frost action:* Low

### **Composition**

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

### **Inclusions**

#### *Contrasting inclusions:*

- The more fertile, sandy Alfic Haplorthods and sandy Entic Haplorthods that have a loamy substratum; in landscape positions similar to those of the Grayling soil

#### *Similar inclusions:*

- Sandy soils that have a banded substratum
- Sandy soils that have a gray subsurface layer
- Sandy soils that are moderately well drained
- Sandy soils that have gravelly textures in the substratum

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, erosion hazard, slope, seasonal droughtiness

#### *Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- The grade should be kept as low as possible.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

### **Interpretive Groups**

*Land capability classification:* VIIs  
*Woodland ordination symbol:* 4R  
*Michigan soil management group:* 5.7a  
*Primary plant association:* Black oak-White oak-Blueberry  
*Secondary plant association:* Mixed oak-Red maple-Starflower

## **210E—Grayling sand, steep Setting**

*Landform:* Deltas  
*Slope range:* 30 to 50 percent  
*Shape of areas:* Linear  
*Size of areas:* 20 to 100 acres

### **Typical Profile**

*Surface layer:*  
 0 to 2 inches—black sand

*Subsoil:*  
 2 to 4 inches—dark yellowish brown, very friable sand  
 4 to 29 inches—yellowish brown, loose sand

*Substratum:*  
 29 to 180 inches—light yellowish brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid  
*Available water capacity:* Low  
*Drainage class:* Excessively drained  
*Seasonal high water table:* At a depth of more than 15 feet  
*Surface runoff:* Rapid  
*Flooding:* None  
*Hazard of water erosion:* Severe  
*Hazard of soil blowing:* Severe  
*Potential for frost action:* Low

### **Composition**

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

### **Inclusions**

#### *Contrasting inclusions:*

- The more fertile, sandy Entic Haplorthods that have a loamy substratum; in landscape positions similar to those of the Grayling soil

*Similar inclusions:*

- Sandy soils that have bands of loamy sand below a depth of 60 inches
- Sandy soils that have a gray subsurface layer
- Sandy soils that have gravelly textures in the substratum

**Use and Management***Land use:* Woodland*Major management concerns:* Equipment limitations, seedling mortality, erosion hazard, slope, seasonal droughtiness*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The grade should be kept as low as possible.
- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely because of the slope. As a result, special logging methods, such as yarding the logs with a cable, may be needed.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate. Replanting is needed in some areas.
- Planting when the soil is moist can reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

**Interpretive Groups***Land capability classification:* VIIIs*Woodland ordination symbol:* 4R*Michigan soil management group:* 5.7a*Primary plant association:* Black oak-White oak-Blueberry*Secondary plant association:* Mixed oak-Red maple-Starflower**211B—Grayling sand, banded substratum, nearly level and undulating****Setting***Landform:* Outwash plains*Slope range:* 0 to 6 percent*Shape of areas:* Irregular*Size of areas:* 20 to 100 acres**Typical Profile***Surface layer:*

0 to 3 inches—black sand

*Subsoil:*

3 to 15 inches—dark yellowish brown, very friable sand

15 to 35 inches—yellowish brown, loose sand

*Substratum:*

35 to 60 inches—light yellowish brown sand

60 to 80 inches—light yellowish brown sand and bands of yellowish brown loamy sand

80 to 180 inches—light yellowish brown sand that has strata of fine sand, coarse sand, or loamy sand

**Soil Properties and Qualities***Permeability:* Rapid*Available water capacity:* Low*Drainage class:* Excessively drained*Seasonal high water table:* At a depth of more than 15 feet*Surface runoff:* Very slow*Flooding:* None*Hazard of water erosion:* Slight*Hazard of soil blowing:* Severe*Potential for frost action:* Low**Composition**

Grayling soil and similar soils: 70 to 90 percent

Contrasting inclusions: 10 to 30 percent

**Inclusions***Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils and the very poorly drained Leafriver and Wakeley soils and dysic Borosaprists; in depressions
- The sandy Entic Haplorthods that have a loamy substratum; in landscape positions similar to those of the Grayling soil

*Similar inclusions:*

- Sandy soils that are not banded
- Sandy soils that have a gray subsurface layer
- Sandy soils that are moderately well drained
- Sandy soils that have gravelly textures in the substratum

**Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

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

**Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* 4S

*Michigan soil management group:* 5.7a

*Primary plant association:* Black oak-White oak-Blueberry

*Secondary plant association:* Mixed oak-Red maple-Starflower

**212B—Grayling sand, very deep water table, nearly level and undulating****Setting**

*Landform:* Outwash plains

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 80 to 600 acres

**Typical Profile**

*Surface layer:*

0 to 3 inches—black sand

*Subsoil:*

3 to 10 inches—dark yellowish brown, very friable sand

10 to 30 inches—yellowish brown, loose sand

*Substratum:*

30 to 70 inches—light yellowish brown sand

70 to 100 inches—light yellowish brown, mottled sand

100 to 180 inches—yellowish brown sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* Apparent, at a depth of 6 to 15 feet at some time from January through December

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

**Composition**

Grayling soil and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

**Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils
- The very poorly drained Leafriver and Wakeley soils and dysic Borosapristis; in depressions

*Similar inclusions:*

- Sandy soils that have a banded substratum
- Sandy soils that have a gray subsurface layer
- Sandy soils that are moderately well drained
- Sandy soils that have a water table below a depth of 15 feet
- Sandy soils that have gravelly textures in the substratum

**Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

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

**Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* 4S

*Michigan soil management group:* 5.7a

*Primary plant association:* Black oak-White oak-Blueberry

*Secondary plant association:* Mixed oak-Red maple-Starflower

## **213B—Graycalm sand, nearly level and undulating**

### **Setting**

*Landform:* Outwash plains and deltas

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 40 acres

### **Typical Profile**

*Surface layer:*

0 to 1 inch—black sand

*Subsoil:*

1 to 4 inches—strong brown, very friable sand

4 to 46 inches—strong brown, very friable loamy sand

46 to 70 inches—light yellowish brown, loose sand with bands of brown, very friable loamy sand

*Substratum:*

70 to 180 inches—stratified coarse sand to loamy sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### **Composition**

Graycalm soil and similar soils: 70 to 90 percent

Contrasting inclusions: 10 to 30 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils
- The very poorly drained, dysic Borosapristis; in depressions

*Similar inclusions:*

- Sandy soils that have a gray subsurface layer
- Sandy soils that have a mottled subsoil between depths of 20 and 40 inches
- Sandy soils that have a dark brown subsoil
- Sandy soils that have a banded substratum

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

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

### **Interpretive Groups**

*Land capability classification:* IVs

*Woodland ordination symbol:* 6S

*Michigan soil management group:* 5a

*Primary plant association:* Black oak-White oak-Blueberry

*Secondary plant association:* Mixed oak-Red maple-Starflower

## **214B—Typic Udipsamments, deep water table, nearly level and undulating**

### **Setting**

*Landform:* Outwash plains

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 100 acres

### **Reference Profile**

*Surface layer:*

0 to 2 inches—black sand

*Subsoil:*

2 to 22 inches—dark yellowish brown, loose sand

*Substratum:*

22 to 37 inches—yellowish brown sand

37 to 80 inches—brownish yellow, mottled sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Moderately well drained

*Seasonal high water table:* Apparent, at a depth of 3.5 to 6.0 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### **Composition**

Typic Udipsamments and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

### **Inclusions**

#### *Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils and Typic Duraquods
- The very poorly drained Leafriver and Wakeley soils and dysic Borosaprists; in depressions

#### *Similar inclusions:*

- Sandy soils that have a banded substratum
- Sandy soils that have a gray subsurface layer
- Sandy soils that have gravelly textures in the substratum

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

#### *Management considerations:*

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

### **Interpretive Groups**

*Land capability classification:* IVs

*Woodland ordination symbol:* 2S

*Michigan soil management group:* 5.7a

*Primary plant association:* Black oak-White oak-Blueberry

*Secondary plant association:* Mixed oak-Red maple-Starflower

## **215B—Typic Udipsamments, loamy substratum, nearly level and undulating**

### **Setting**

*Landform:* Outwash plains and deltas

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 20 acres

### **Reference Profile**

*Surface layer:*

0 to 2 inches—very dark grayish brown sand

#### *Subsoil:*

2 to 15 inches—dark yellowish brown, very friable sand

15 to 25 inches—yellowish brown, loose sand

#### *Substratum:*

25 to 75 inches—brownish yellow sand

75 to 95 inches—strong brown sandy clay loam

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### **Composition**

Typic Udipsamments and similar soils: 70 to 90 percent

Contrasting inclusions: 10 to 30 percent

### **Inclusions**

#### *Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils and Argic Endoaquods
- The very poorly drained, dysic Borosaprists in depressions and drainageways
- The sandy Entic Haplorthods that have a loamy substratum; in landscape positions similar to those of the Typic Udipsamments

#### *Similar inclusions:*

- Sandy soils that are moderately well drained
- Sandy soils that have a coarse textured substratum
- Sandy soils that have a surface layer of loamy sand or fine sand
- Sandy soils that have a banded substratum

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

#### *Management considerations:*

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

### **Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Black oak-White oak-  
Blueberry

*Secondary plant association:* Mixed oak-Red maple-  
Starflower

### **216B—Typic Udipsamments, loamy calcareous substratum, nearly level and undulating**

#### **Setting**

*Landform:* Outwash plains and deltas

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 200 acres

#### **Reference Profile**

*Surface layer:*

0 to 2 inches—very dark grayish brown sand

*Subsoil:*

2 to 15 inches—dark yellowish brown, very friable sand

15 to 25 inches—yellowish brown, loose sand

*Substratum:*

25 to 75 inches—brownish yellow sand

75 to 95 inches—strong brown, calcareous sandy clay loam

#### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

#### **Composition**

Typic Udipsamments and similar soils: 70 to 90 percent

Contrasting inclusions: 10 to 30 percent

#### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils and Argic Endoaquods

- The very poorly drained, dysic Borosaprists in depressions and drainageways
- The sandy Entic Haplorthods that have a loamy substratum; in landscape positions similar to those of the Typic Udipsamments

*Similar inclusions:*

- Sandy soils that are moderately well drained
- Sandy soils that have a coarse textured substratum
- Sandy soils that have a surface layer of loamy sand or fine sand
- Sandy soils that have a banded substratum

#### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

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

#### **Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* 3S

*Michigan soil management group:* None assigned

*Primary plant association:* Black oak-White oak-  
Blueberry

*Secondary plant association:* Mixed oak-Red maple-  
Starflower

### **220B—Typic Udipsamments, nearly level and undulating**

#### **Setting**

*Landform:* Moraines and deltas

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 50 acres

#### **Reference Profile**

*Surface layer:*

0 to 2 inches—very dark gray sand

*Subsurface layer:*

2 to 4 inches—light brownish gray sand

*Subsoil:*

4 to 22 inches—dark yellowish brown, very friable sand

22 to 40 inches—yellowish brown, loose sand

*Substratum:*  
40 to 180 inches—light yellowish brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid  
*Available water capacity:* Low  
*Drainage class:* Excessively drained  
*Seasonal high water table:* At a depth of more than 15 feet  
*Surface runoff:* Very slow  
*Flooding:* None  
*Hazard of water erosion:* Slight  
*Hazard of soil blowing:* Severe  
*Potential for frost action:* Low

### **Composition**

Typic Udipsamments and similar soils: 80 to 90 percent  
Contrasting inclusions: 10 to 20 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils
- The very poorly drained Leafriver and Wakeley soils and dysic Borosaprists; in depressions and drainageways
- The well drained Eutroboralfs in landscape positions similar to those of the Typic Udipsamments

*Similar inclusions:*

- Sandy soils that are moderately well drained
- Sandy soils that have a fine textured substratum
- Sandy soils that have a surface layer of loamy sand or fine sand

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

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

### **Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Black oak-White oak-Blueberry

## **220D—Typic Udipsamments, hilly Setting**

*Landform:* Moraines and deltas  
*Slope range:* 18 to 30 percent  
*Shape of areas:* Linear  
*Size of areas:* 10 to 50 acres

### **Reference Profile**

*Surface layer:*  
0 to 2 inches—very dark gray sand

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

*Subsoil:*  
4 to 12 inches—yellowish brown, very friable sand  
12 to 40 inches—brownish yellow, loose sand

*Substratum:*  
40 to 180 inches—light yellowish brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid  
*Available water capacity:* Low  
*Drainage class:* Excessively drained  
*Seasonal high water table:* At a depth of more than 15 feet  
*Surface runoff:* Medium  
*Flooding:* None  
*Hazard of water erosion:* Moderate  
*Hazard of soil blowing:* Severe  
*Potential for frost action:* Low

### **Composition**

Typic Udipsamments and similar soils: 80 to 90 percent  
Contrasting inclusions: 10 to 20 percent

### **Inclusions**

*Contrasting inclusions:*

- The well drained Eutroboralfs in landscape positions similar to those of the Typic Udipsamments

*Similar inclusions:*

- Sandy soils that have a banded substratum
- Sandy soils that have a surface layer of loamy sand or fine sand
- Sandy soils that have a gravelly substratum

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, erosion hazard, seedling mortality, slope, seasonal droughtiness

*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The grade should be kept as low as possible.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The hazard of erosion can be reduced by seeding logging roads and landings and by installing water bars and culverts.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

### **Interpretive Groups**

*Land capability classification:* VIIIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Black oak-White oak-Blueberry

## **220E—Typic Udipsamments, steep**

### **Setting**

*Landform:* Moraines and deltas

*Slope range:* 30 to 50 percent

*Shape of areas:* Linear

*Size of areas:* 10 to 100 acres

### **Reference Profile**

*Surface layer:*

0 to 2 inches—very dark gray sand

*Subsurface layer:*

2 to 4 inches—light brownish gray sand

*Subsoil:*

4 to 12 inches—yellowish brown, very friable sand

12 to 40 inches—brownish yellow, loose sand

*Substratum:*

40 to 180 inches—light yellowish brown sand

## **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

## **Composition**

Typic Udipsamments and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

## **Inclusions**

*Contrasting inclusions:*

- The well drained, sandy over loamy Alfic Haplorthods and the well drained Eutroboralfs; in landscape positions similar to those of the Typic Udipsamments

*Similar inclusions:*

- Sandy soils that have fine textured bands in the substratum
- Sandy soils that have a surface layer of loamy sand or fine sand
- Sandy soils that have a gravelly substratum

## **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, erosion hazard, slope, seasonal droughtiness

*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The grade should be kept as low as possible.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

### **Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Black oak-White oak-Blueberry

## **221B—Typic Udipsamments, banded substratum, nearly level and undulating**

### **Setting**

*Landform:* Moraines and deltas

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 400 acres

### **Reference Profile**

*Surface layer:*

0 to 3 inches—very dark gray sand

*Subsoil:*

3 to 6 inches—dark brown, very friable sand

6 to 20 inches—strong brown, loose sand

20 to 30 inches—brownish yellow, loose sand

*Substratum:*

30 to 45 inches—light yellowish brown sand

45 to 75 inches—light yellowish brown sand that has bands of dark yellowish brown loamy sand

75 to 85 inches—brown loamy sand

85 to 180 inches—light yellowish brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### **Composition**

Typic Udipsamments and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils
- The very poorly drained Leafriver and Wakeley soils and dysic Borosaprists; in depressions and drainageways
- The well drained Eutroboralfs and sandy over loamy Alfic Haplorthods; in landscape positions similar to those of the Typic Udipsamments

*Similar inclusions:*

- Sandy soils that are moderately well drained
- Sandy soils that have fine textured bands in the substratum
- Sandy soils that have a surface layer of loamy sand or fine sand
- Sandy soils that have a gravelly substratum

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

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

### **Interpretive Groups**

*Land capability classification:* VI<sub>s</sub>

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Black oak-White oak-Blueberry

## **221C—Typic Udipsamments, banded substratum, rolling**

### **Setting**

*Landform:* Moraines

*Slope range:* 6 to 18 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 400 acres

### **Reference Profile**

*Surface layer:*

0 to 3 inches—very dark gray sand

**Subsoil:**

3 to 6 inches—dark brown, very friable sand  
 6 to 20 inches—strong brown, loose sand  
 20 to 30 inches—brownish yellow, loose sand

**Substratum:**

30 to 45 inches—light yellowish brown sand  
 45 to 75 inches—light yellowish brown sand that has  
 bands of dark yellowish brown loamy sand  
 75 to 85 inches—brown loamy sand  
 85 to 180 inches—light yellowish brown sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

**Composition**

Typic Udipsamments and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

**Inclusions****Contrasting inclusions:**

- The somewhat poorly drained Au Gres soils
- The very poorly drained Leafriver and Wakeley soils and dysic Borosapristis; in depressions and drainageways
- The well drained Eutroboralfs and sandy over loamy Alfic Haplorthods; in landscape positions similar to those of the Typic Udipsamments

**Similar inclusions:**

- Sandy soils that are moderately well drained
- Sandy soils that have fine textured bands in the substratum
- Sandy soils that have a surface layer of loamy sand or fine sand
- Sandy soils that have a gravelly substratum

**Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

**Management considerations:**

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.

- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

**Interpretive Groups**

*Land capability classification:* VIIIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Black oak-White oak-Blueberry

**221D—Typic Udipsamments, banded substratum, hilly****Setting**

*Landform:* Moraines and deltas

*Slope range:* 18 to 30 percent

*Shape of areas:* Linear

*Size of areas:* 10 to 200 acres

**Reference Profile****Surface layer:**

0 to 3 inches—very dark gray sand

**Subsoil:**

3 to 6 inches—dark brown, very friable sand  
 6 to 20 inches—strong brown, loose sand  
 20 to 30 inches—brownish yellow, loose sand

**Substratum:**

30 to 45 inches—light yellowish brown sand  
 45 to 75 inches—light yellowish brown sand that has  
 bands of dark yellowish brown loamy sand  
 75 to 85 inches—brown loamy sand  
 85 to 180 inches—light yellowish brown sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### **Composition**

Typic Udipsamments and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

### **Inclusions**

#### *Contrasting inclusions:*

- The sandy over loamy Alfic Haplorthods and the sandy Entic Haplorthods that have a loamy substratum; in landscape positions similar to those of the Typic Udipsamments

#### *Similar inclusions:*

- Sandy soils that have fine textured bands in the substratum
- Sandy soils that have a surface layer of loamy sand or fine sand
- Sandy soils that have a gravelly substratum

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, erosion hazard, slope, seasonal droughtiness

#### *Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

### **Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Black oak-White oak-Blueberry

## **221E—Typic Udipsamments, banded substratum, steep**

### **Setting**

*Landform:* Moraines and deltas

*Slope range:* 30 to 50 percent

*Shape of areas:* Linear

*Size of areas:* 10 to 200 acres

### **Reference Profile**

#### *Surface layer:*

0 to 3 inches—very dark gray sand

#### *Subsoil:*

3 to 6 inches—dark brown, very friable sand

6 to 20 inches—strong brown, loose sand

20 to 30 inches—brownish yellow, loose sand

#### *Substratum:*

30 to 60 inches—light yellowish brown sand

60 to 75 inches—light yellowish brown sand that has bands of dark yellowish brown loamy sand

75 to 85 inches—brown loamy sand

85 to 180 inches—light yellowish brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### **Composition**

Typic Udipsamments and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

### **Inclusions**

#### *Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils and Argic Endoaquods
- The very poorly drained, dysic Borosaprists in depressions and drainageways
- The well drained Klacking soils and Eutroboralfs; in landscape positions similar to those of the Typic Udipsamments

#### *Similar inclusions:*

- Sandy soils that are moderately well drained

- Sandy soils that have a surface layer of loamy sand or fine sand
- Sandy soils that have gravelly sand in the substratum
- Sandy soils that have bands in the lower part of the subsoil

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, erosion hazard, slope, seasonal droughtiness

*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely because of the slope. As a result, special logging methods, such as yarding the logs with a cable, may be needed.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

### **Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Black oak-White oak-Blueberry

## **222B—Typic Udipsamments, very deep water table, nearly level and undulating**

### **Setting**

*Landform:* Outwash plains

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 400 acres

### **Reference Profile**

*Surface layer:*

0 to 2 inches—very dark gray sand

*Subsoil:*

2 to 5 inches—dark brown, very friable sand

5 to 15 inches—strong brown, loose sand

15 to 30 inches—yellowish brown, loose sand

*Substratum:*

30 to 80 inches—light yellowish brown sand

80 to 90 inches—yellowish brown, mottled sand

90 to 100 inches—yellowish brown, saturated sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Well drained

*Seasonal high water table:* Apparent, at a depth of 5 to 15 feet at some time from January through December

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### **Composition**

Typic Udipsamments and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils
- The very poorly drained Leafriver and Wakeley soils and dysic Borosaprists; in depressions and drainageways

*Similar inclusions:*

- Sandy soils that have a fine textured substratum
- Sandy soils that have a surface layer of loamy sand or fine sand
- Sandy soils that do not have mottles in the substratum
- Sandy soils that have a gravelly substratum

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.

- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

### **Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Black oak-White oak-Blueberry

## **223B—Graycalm-Grayling sands, nearly level and undulating**

### **Setting**

*Landform:* Outwash plains and deltas

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 200 acres

### **Typical Profile**

#### **Graycalm**

*Surface layer:*

0 to 1 inch—black sand

*Subsoil:*

1 to 4 inches—strong brown, very friable sand

4 to 46 inches—strong brown, loose loamy sand

46 to 70 inches—light yellowish brown, loose sand with bands of brown, very friable loamy sand

*Substratum:*

70 to 180 inches—stratified coarse sand to loamy sand

#### **Grayling**

*Surface layer:*

0 to 2 inches—black sand

*Subsoil:*

2 to 4 inches—dark yellowish brown, very friable sand

4 to 29 inches—yellowish brown, loose sand

*Substratum:*

29 to 180 inches—light yellowish brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Graycalm—somewhat excessively drained; Grayling—excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### **Composition**

Graycalm, Grayling, and similar soils: 70 to 90 percent

Contrasting inclusions: 10 to 30 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils
- The very poorly drained Leafriver and Wakeley soils and dysic Borosapristis; in depressions and drainageways

*Similar inclusions:*

- Sandy soils that are moderately well drained
- Sandy soils that have a surface layer of loamy sand or fine sand
- Sandy soils that have a gravelly substratum

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

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

### **Interpretive Groups**

*Land capability classification:* IVs

*Woodland ordination symbol:* Graycalm—6S; Grayling—4S

*Michigan soil management group:* Graycalm—5a; Grayling—5.7a

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Black oak-White oak-Blueberry

## **223C—Graycalm-Grayling sands, rolling**

### **Setting**

*Landform:* Outwash plains and deltas

*Slope range:* 6 to 18 percent

*Shape of areas:* Irregular  
*Size of areas:* 20 to 80 acres

### **Typical Profile**

#### **Graycalm**

*Surface layer:*  
 0 to 1 inch—black sand

*Subsoil:*  
 1 to 4 inches—strong brown, very friable sand  
 4 to 46 inches—strong brown, loose loamy sand  
 46 to 70 inches—light yellowish brown, loose sand  
 with bands of brown, very friable loamy sand

*Substratum:*  
 70 to 180 inches—stratified coarse sand to loamy sand

#### **Grayling**

*Surface layer:*  
 0 to 2 inches—black sand

*Subsoil:*  
 2 to 4 inches—dark yellowish brown, very friable sand  
 4 to 29 inches—yellowish brown, loose sand

*Substratum:*  
 29 to 180 inches—light yellowish brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid  
*Available water capacity:* Low  
*Drainage class:* Graycalm—somewhat excessively drained; Grayling—excessively drained  
*Seasonal high water table:* At a depth of more than 15 feet  
*Surface runoff:* Medium  
*Flooding:* None  
*Hazard of water erosion:* Moderate  
*Hazard of soil blowing:* Severe  
*Potential for frost action:* Low

### **Composition**

Graycalm, Grayling, and similar soils: 70 to 90 percent  
 Contrasting inclusions: 10 to 30 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils
- The very poorly drained Leafriver and Wakeley soils and dysic Borosaprists; in depressions and drainageways
- The well drained, sandy over loamy Alfic Haplorthods and the well drained Eutroboralfs; in landscape positions similar to those of the major soils

### *Similar inclusions:*

- Sandy soils that are moderately well drained
- Sandy soils that have a gravelly substratum
- Sandy soils that have a surface layer of loamy sand or fine sand

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

### *Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

### **Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* Graycalm—6S;  
 Grayling—4S

*Michigan soil management group:* Graycalm—5a;  
 Grayling—5.7a

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Black oak-White oak-Blueberry

## **223D—Graycalm-Grayling sands, hilly**

### **Setting**

*Landform:* Outwash plains and deltas  
*Slope range:* 18 to 30 percent  
*Shape of areas:* Linear  
*Size of areas:* 10 to 20 acres

### **Typical Profile**

#### **Graycalm**

*Surface layer:*  
 0 to 1 inch—black sand

*Subsoil:*  
 1 to 4 inches—strong brown, very friable sand  
 4 to 46 inches—strong brown, loose loamy sand  
 46 to 70 inches—light yellowish brown, loose sand  
 with bands of brown, very friable loamy sand

*Substratum:*  
 70 to 180 inches—stratified coarse sand to loamy sand

**Grayling***Surface layer:*

0 to 2 inches—black sand

*Subsoil:*

2 to 4 inches—dark yellowish brown, very friable sand  
4 to 29 inches—yellowish brown, loose sand

*Substratum:*

29 to 180 inches—light yellowish brown sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Graycalm—somewhat excessively drained; Grayling—excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

**Composition**

Graycalm, Grayling, and similar soils: 70 to 90 percent  
Contrasting inclusions: 10 to 30 percent

**Inclusions***Contrasting inclusions:*

- The well drained, sandy over loamy Alfic Haplorthods and the well drained Eutroboralfs; in landscape positions similar to those of the major soils

*Similar inclusions:*

- Sandy soils that have coarse textured bands in the substratum
- Sandy soils that have a surface layer of loamy sand or fine sand
- Sandy soils that have a gravelly substratum

**Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, erosion hazard, seasonal droughtiness

*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The grade should be kept as low as possible.

- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

**Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* Graycalm—6R; Grayling—4R

*Michigan soil management group:* Graycalm—5a; Grayling—5.7a

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Black oak-White oak-Blueberry

**223E—Graycalm-Grayling sands, steep****Setting**

*Landform:* Outwash plains and deltas

*Slope range:* 30 to 50 percent

*Shape of areas:* Linear

*Size of areas:* 10 to 40 acres

**Typical Profile****Graycalm***Surface layer:*

0 to 1 inch—black sand

*Subsoil:*

1 to 4 inches—strong brown, very friable sand  
4 to 46 inches—strong brown, loose loamy sand  
46 to 70 inches—light yellowish brown, loose sand with bands of brown, very friable loamy sand

*Substratum:*

70 to 180 inches—stratified coarse sand to loamy sand

**Grayling***Surface layer:*

0 to 2 inches—black sand

*Subsoil:*

2 to 4 inches—dark yellowish brown, very friable sand  
4 to 29 inches—yellowish brown, loose sand

*Substratum:*

29 to 180 inches—light yellowish brown sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Graycalm—somewhat excessively drained; Grayling—excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

**Composition**

Graycalm, Grayling, and similar soils: 70 to 90 percent

Contrasting inclusions: 10 to 30 percent

**Inclusions***Contrasting inclusions:*

- The well drained, sandy over loamy Alfic Haplorthods and the well drained Eutroboralfs; in landscape positions similar to those of the major soils

*Similar inclusions:*

- Sandy soils that have coarse textured bands in the substratum
- Sandy soils that have a surface layer of loamy sand or fine sand
- Sandy soils that have a gravelly substratum

**Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, erosion hazard, seasonal droughtiness, slope

*Management considerations:*

- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely because of the slope. As a result, special logging methods, such as yarding the logs with a cable, may be needed.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The grade should be kept as low as possible.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Planting when the soil is moist can reduce the

seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

**Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* Graycalm—6R;

Grayling—4R

*Michigan soil management group:* Graycalm—5a;

Grayling—5.7a

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Black oak-White oak-Blueberry

**224B—Crowell sand, nearly level and undulating****Setting**

*Landform:* Outwash plains

*Slope range:* 0 to 4 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 200 acres

**Typical Profile***Organic mat:*

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

*Subsurface layer:*

1 to 4 inches—dark grayish brown sand

*Subsoil:*

4 to 10 inches—dark brown, very friable sand

10 to 20 inches—strong brown, loose sand

20 to 29 inches—brownish yellow, mottled, loose sand

*Substratum:*

29 to 99 inches—yellowish brown and light yellowish brown, mottled sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Moderately well drained

*Seasonal high water table:* Apparent, at a depth of 2.0 to 3.5 feet at some time from November through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

**Composition**

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

**Inclusions***Contrasting inclusions:*

- The very poorly drained Leafriver and Wakeley soils and dysic Borosapristis; in depressions and drainageways

*Similar inclusions:*

- Sandy soils that have a banded substratum
- Sandy soils that have a surface layer of loamy sand
- Sandy soils that do not have mottles in the substratum
- Sandy soils that are moderately well drained

**Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Special harvest methods may be needed to control undesirable plants.
- Carefully managed reforestation helps to control undesirable understory plants.

**Interpretive Groups**

*Land capability classification:* IVs

*Woodland ordination symbol:* 5S

*Michigan soil management group:* 5a

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Black oak-White oak-Blueberry

**225B—Entic Haplorthods, sandy, loamy substratum, nearly level and undulating**

**Setting**

*Landform:* Moraines

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 100 acres

**Reference Profile***Surface layer:*

0 to 2 inches—very dark gray sand

*Subsurface layer:*

2 to 4 inches—grayish brown sand

*Subsoil:*

4 to 8 inches—dark brown, very friable sand

8 to 15 inches—dark yellowish brown, loose sand

15 to 30 inches—yellowish brown, loose sand

*Substratum:*

30 to 55 inches—strong brown sand

55 to 80 inches—reddish brown sandy clay loam

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

**Composition**

Entic Haplorthods and similar soils: 70 to 90 percent

Contrasting inclusions: 10 to 30 percent

**Inclusions***Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils
- The very poorly drained Leafriver and Wakeley soils and dysic Borosapristis; in depressions and drainageways
- The well drained Eutroboralfs in landscape positions similar to those of the Entic Haplorthods

*Similar inclusions:*

- Sandy soils that are moderately well drained
- Sandy soils that have a coarse textured substratum
- Sandy soils that have a surface layer of loamy sand or fine sand

**Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of

wheeled equipment, logging roads should be stabilized.

- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

### **Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Northern red oak-Red maple-Mapleleaf viburnum

## **225C—Entic Haplorthods, sandy, loamy substratum, rolling**

### **Setting**

*Landform:* Moraines

*Slope range:* 6 to 18 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 100 acres

### **Reference Profile**

*Surface layer:*

0 to 2 inches—very dark gray sand

*Subsurface layer:*

2 to 4 inches—grayish brown sand

*Subsoil:*

4 to 8 inches—dark brown, very friable sand

8 to 15 inches—strong brown, loose sand

15 to 30 inches—yellowish brown, loose sand

*Substratum:*

30 to 55 inches—strong brown sand

55 to 80 inches—reddish brown sandy clay loam

### **Soil Properties and Qualities**

*Permeability:* Rapid in the sandy part and moderately slow in the loamy part

*Available water capacity:* Low

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Low

### **Composition**

Entic Haplorthods and similar soils: 70 to 90 percent

Contrasting inclusions: 10 to 30 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils
- The very poorly drained Leafriver and Wakeley soils and dysic Borosaprists; in depressions and drainageways
- The well drained Eutroboralfs in landscape positions similar to those of the Entic Haplorthods

*Similar inclusions:*

- Sandy soils that are moderately well drained
- Sandy soils that have a coarse textured substratum
- Sandy soils that have a surface layer of loamy sand or fine sand

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

### **Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Mixed oak-Red maple-Starflower

*Secondary plant association:* Northern red oak-Red maple-Mapleleaf viburnum

## **231D—Entic Haplorthods, sandy, banded substratum-Alfic Haplorthods, sandy, complex, hilly**

### **Setting**

*Landform:* Moraines

*Slope range:* 18 to 30 percent

*Shape of areas:* Linear

*Size of areas:* 10 to 20 acres

### Reference Profile

#### Entic Haplorthods

*Surface layer:*

0 to 2 inches—very dark gray sand

*Subsurface layer:*

2 to 4 inches—brown sand

*Subsoil:*

4 to 8 inches—dark brown, very friable sand

8 to 20 inches—strong brown, loose sand

20 to 30 inches—brownish yellow, loose sand

*Substratum:*

30 to 60 inches—light yellowish brown sand

60 to 75 inches—light yellowish brown sand that has bands of dark yellowish brown loamy sand

75 to 85 inches—brown loamy sand

85 to 180 inches—light yellowish brown sand

#### Alfic Haplorthods

*Organic mat:*

0 to 2 inches—partially decomposed hardwood leaf litter

*Surface layer:*

2 to 4 inches—very dark gray loamy sand

*Subsurface layer:*

4 to 7 inches—grayish brown sand

*Subsoil:*

7 to 10 inches—dark brown, very friable loamy sand

10 to 17 inches—strong brown, loose sand

17 to 37 inches—yellowish brown, loose sand

37 to 42 inches—dark brown, very friable sandy loam

*Substratum:*

42 to 77 inches—reddish yellow sand

77 to 180 inches—brownish yellow sand

### Soil Properties and Qualities

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Entic Haplorthods—excessively drained; Alfic Haplorthods—well drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Entic Haplorthods—severe; Alfic Haplorthods—moderate

*Potential for frost action:* Low

### Composition

Entic Haplorthods and similar soils: 40 to 70 percent

Alfic Haplorthods and similar soils: 20 to 50 percent  
Contrasting inclusions: 5 to 30 percent

### Inclusions

*Contrasting inclusions:*

- The very poorly drained, dysic and euic Borosaprists in depressions and drainageways

*Similar inclusions:*

- Sandy soils that have a loamy substratum

### Use and Management

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, erosion hazard, slope, and seasonal droughtiness in areas of both soils; plant competition an additional concern in areas of the Alfic Haplorthods

*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The grade should be kept as low as possible.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.
- Carefully managed reforestation helps to control undesirable understory plants.

### Interpretive Groups

*Land capability classification:* VIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Northern red oak-Red maple-Mapleleaf viburnum

*Secondary plant association:* Mixed oak-Red maple-Starflower

### 231E—Entic Haplorthods, sandy, banded substratum-Alfic Haplorthods, sandy, complex, steep

#### Setting

*Landform:* Moraines

*Slope range:* 30 to 50 percent

*Shape of areas:* Linear  
*Size of areas:* 10 to 40 acres

### **Reference Profile**

#### **Entic Haplorthods**

*Surface layer:*  
 0 to 2 inches—very dark gray sand

*Subsurface layer:*  
 2 to 4 inches—brown sand

*Subsoil:*  
 4 to 8 inches—dark brown, very friable sand  
 8 to 20 inches—strong brown, loose sand  
 20 to 30 inches—brownish yellow, loose sand

*Substratum:*  
 30 to 60 inches—light yellowish brown sand  
 60 to 75 inches—light yellowish brown sand that has  
 bands of dark yellowish brown loamy sand  
 75 to 85 inches—brown loamy sand  
 85 to 180 inches—light yellowish brown sand

#### **Alfic Haplorthods**

*Organic mat:*  
 0 to 2 inches—partially decomposed hardwood leaf  
 litter

*Surface layer:*  
 2 to 4 inches—very dark gray sand

*Subsurface layer:*  
 4 to 7 inches—grayish brown sand

*Subsoil:*  
 7 to 10 inches—dark brown, very friable loamy sand  
 10 to 17 inches—strong brown, loose sand  
 17 to 37 inches—yellowish brown, loose sand  
 37 to 42 inches—dark brown, very friable sandy  
 loam

*Substratum:*  
 42 to 77 inches—reddish yellow sand  
 77 to 180 inches—brownish yellow sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Entic Haplorthods—excessively  
 drained; Alfic Haplorthods—well drained

*Seasonal high water table:* At a depth of more than 15  
 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Entic Haplorthods—severe;  
 Alfic Haplorthods—moderate  
*Potential for frost action:* Low

### **Composition**

Entic Haplorthods and similar soils: 40 to 70 percent  
 Alfic Haplorthods and similar soils: 20 to 50 percent  
 Contrasting inclusions: 5 to 30 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained, dysic and euic Borosaprists in depressions and drainageways

*Similar inclusions:*

- Sandy soils that have a loamy substratum

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations,  
 seedling mortality, erosion hazard, slope, and  
 seasonal droughtiness in areas of both soils; plant  
 competition an additional concern in areas of the  
 Alfic Haplorthods

*Management considerations:*

- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely because of the slope. As a result, special logging methods, such as yarding the logs with a cable, may be needed.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.
- Planting when the soil is moist can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.
- Carefully managed reforestation helps to control undesirable understory plants.

### **Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Northern red oak-Red  
 maple-Mapleleaf viburnum

*Secondary plant association:* Mixed oak-Red maple-  
 Starflower

**232B—Entic Haplorthods, sandy-Alfic Haplorthods, sandy, complex, very deep water table, nearly level and undulating**

**Setting**

*Landform:* Outwash plains and deltas  
*Slope range:* 0 to 6 percent  
*Shape of areas:* Irregular  
*Size of areas:* 10 to 100 acres

**Reference Profile**

**Entic Haplorthods**

*Surface layer:*  
 0 to 2 inches—very dark gray sand

*Subsurface layer:*  
 2 to 3 inches—grayish brown sand

*Subsoil:*  
 3 to 7 inches—dark brown, very friable sand  
 7 to 15 inches—strong brown, loose sand  
 15 to 30 inches—yellowish brown, loose sand

*Substratum:*  
 30 to 80 inches—light yellowish brown, mottled sand  
 80 to 90 inches—yellowish brown, mottled sand  
 90 to 100 inches—yellowish brown, saturated sand

**Alfic Haplorthods**

*Organic mat:*  
 0 to 2 inches—partially decomposed hardwood leaf litter

*Surface layer:*  
 2 to 4 inches—very dark gray sand

*Subsurface layer:*  
 4 to 7 inches—grayish brown sand

*Subsoil:*  
 7 to 10 inches—dark brown, very friable loamy sand  
 10 to 17 inches—strong brown, loose sand  
 17 to 37 inches—yellowish brown, loose sand  
 37 to 42 inches—dark brown, very friable sandy loam

*Substratum:*  
 42 to 70 inches—reddish yellow, mottled sand  
 70 to 180 inches—brownish yellow, saturated sand

**Soil Properties and Qualities**

*Permeability:* Entic Haplorthods—rapid; Alfic Haplorthods—rapid in the sandy part and moderately slow in the loamy part

*Available water capacity:* Low  
*Drainage class:* Well drained  
*Seasonal high water table:* Apparent, at a depth of 5 to 15 feet at some time from October through May  
*Surface runoff:* Slow  
*Flooding:* None  
*Hazard of water erosion:* Slight  
*Hazard of soil blowing:* Entic Haplorthods—severe; Alfic Haplorthods—moderate  
*Potential for frost action:* Low

**Composition**

Entic Haplorthods and similar soils: 40 to 70 percent  
 Alfic Haplorthods and similar soils: 20 to 50 percent  
 Contrasting inclusions: 5 to 30 percent

**Inclusions**

*Contrasting inclusions:*

- The very poorly drained Leafriver and Wakeley soils and dysic and euc Borosaprists; in depressions and drainageways

*Similar inclusions:*

- Sandy soils that have a loamy substratum
- Sandy soils that have a banded substratum

**Use and Management**

*Land use:* Woodland

*Major management concerns:* Alfic Haplorthods—plant competition; Entic Haplorthods—equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

**Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Northern red oak-Red maple-Mapleleaf viburnum

*Secondary plant association:* Mixed oak-Red maple-Starflower

**233B—Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine-loamy banded substratum, complex, nearly level and undulating**

**Setting**

*Landform:* Moraines  
*Slope range:* 0 to 6 percent  
*Shape of areas:* Irregular  
*Size of areas:* 47 acres

**Reference Profile**

**Alfic Haplorthods**

*Organic mat:*  
 0 to 2 inches—partially decomposed hardwood leaf litter

*Surface layer:*  
 2 to 4 inches—very dark gray sand

*Subsurface layer:*  
 4 to 7 inches—grayish brown sand

*Subsoil:*  
 7 to 11 inches—dark brown, very friable loamy sand  
 11 to 32 inches—strong brown, loose sand  
 32 to 37 inches—yellowish brown, loose sand  
 37 to 42 inches—dark brown, very friable sandy loam

*Substratum:*  
 42 to 77 inches—reddish yellow sand  
 77 to 180 inches—brownish yellow sand

**Entic Haplorthods**

*Surface layer:*  
 0 to 2 inches—dark grayish brown sand

*Subsurface layer:*  
 2 to 3 inches—pale brown sand

*Subsoil:*  
 3 to 6 inches—dark brown, very friable sand  
 6 to 15 inches—strong brown, loose sand  
 15 to 30 inches—yellowish brown, loose sand  
 30 to 55 inches—light yellowish brown, loose sand

*Substratum:*  
 55 to 70 inches—yellowish brown sand with bands of sandy clay loam  
 70 to 95 inches—light yellowish brown, stratified sand

**Soil Properties and Qualities**

*Permeability:* Rapid  
*Available water capacity:* Low

*Drainage class:* Alfic Haplorthods—well drained; Entic Haplorthods—excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Alfic Haplorthods—moderate; Entic Haplorthods—severe

*Potential for frost action:* Low

**Composition**

Alfic Haplorthods and similar soils: 40 to 80 percent  
 Entic Haplorthods and similar soils: 20 to 50 percent  
 Contrasting inclusions: 5 to 20 percent

**Inclusions**

*Contrasting inclusions:*

- The very poorly drained Leafriver and Wakeley soils and eucic Borosaprists; in depressions and drainageways

*Similar inclusions:*

- Sandy soils that have a fine-loamy substratum

**Use and Management**

*Land use:* Woodland

*Major management concerns:* Alfic Haplorthods—seedling mortality, seasonal droughtiness, plant competition; Entic Haplorthods—equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Carefully managed reforestation helps to control undesirable understory plants.

**Interpretive Groups**

*Land capability classification:* IIIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Northern red oak-Red maple-Mapleleaf viburnum

*Secondary plant association:* Mixed oak-Red maple-Starflower

**233C—Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine-loamy banded substratum, complex, rolling**

**Setting**

*Landform:* Moraines  
*Slope range:* 6 to 18 percent  
*Shape of areas:* Irregular  
*Size of areas:* 25 acres

**Reference Profile**

**Alfic Haplorthods**

*Organic mat:*  
 0 to 2 inches—partially decomposed hardwood leaf litter

*Surface layer:*  
 2 to 4 inches—very dark gray sand

*Subsurface layer:*  
 4 to 7 inches—grayish brown sand

*Subsoil:*  
 7 to 11 inches—dark brown, very friable loamy sand  
 11 to 32 inches—strong brown, loose sand  
 32 to 37 inches—yellowish brown, loose sand  
 37 to 42 inches—dark brown, very friable sandy loam

*Substratum:*  
 42 to 77 inches—reddish yellow sand  
 77 to 180 inches—brownish yellow sand

**Entic Haplorthods**

*Surface layer:*  
 0 to 2 inches—dark grayish brown sand

*Subsurface layer:*  
 2 to 3 inches—pale brown sand

*Subsoil:*  
 3 to 6 inches—dark brown, very friable sand  
 6 to 15 inches—strong brown, loose sand  
 15 to 30 inches—yellowish brown, loose sand  
 30 to 55 inches—light yellowish brown, loose sand

*Substratum:*  
 55 to 70 inches—yellowish brown sand with bands of sandy clay loam  
 70 to 95 inches—light yellowish brown, stratified sand

**Soil Properties and Qualities**

*Permeability:* Rapid  
*Available water capacity:* Low

*Drainage class:* Alfic Haplorthods—well drained; Entic Haplorthods—excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Alfic Haplorthods—moderate; Entic Haplorthods—severe

*Potential for frost action:* Low

**Composition**

Alfic Haplorthods and similar soils: 40 to 80 percent  
 Entic Haplorthods and similar soils: 20 to 50 percent  
 Contrasting inclusions: 5 to 20 percent

**Inclusions**

*Contrasting inclusions:*

- The very poorly drained Leafriver and Wakeley soils and eucic Borosaprists; in depressions and drainageways

*Similar inclusions:*

- Sandy soils that have a fine-loamy substratum
- Sandy soils that do not have a dark brown subsoil

**Use and Management**

*Land use:* Woodland

*Major management concerns:* Alfic Haplorthods—equipment limitations, seedling mortality, seasonal droughtiness, plant competition, erosion hazard, slope; Entic Haplorthods—equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.
- Carefully managed reforestation helps to control undesirable understory plants.

**Interpretive Groups**

*Land capability classification:* IVe

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Northern red oak-Red maple-Mapleleaf viburnum

*Secondary plant association:* Mixed oak-Red maple-Starflower

**233D—Alfic Haplorthods, sandy-Entic Haplorthods, sandy, fine-loamy banded substratum, complex, hilly**

**Setting**

*Landform:* Sandy moraines  
*Slope range:* 18 to 30 percent  
*Shape of areas:* Linear  
*Size of areas:* 46 acres

**Reference Profile**

**Alfic Haplorthods**

*Organic mat:*  
 0 to 2 inches—partially decomposed hardwood leaf litter

*Surface layer:*  
 2 to 4 inches—very dark gray sand

*Subsurface layer:*  
 4 to 7 inches—grayish brown sand

*Subsoil:*  
 7 to 11 inches—dark brown, very friable loamy sand  
 11 to 32 inches—strong brown, loose sand  
 32 to 37 inches—yellowish brown, loose sand  
 37 to 42 inches—dark brown, very friable sandy loam

*Substratum:*  
 42 to 77 inches—reddish yellow sand  
 77 to 180 inches—brownish yellow sand

**Entic Haplorthods**

*Surface layer:*  
 0 to 2 inches—dark grayish brown sand

*Subsurface layer:*  
 2 to 3 inches—pale brown sand

*Subsoil:*  
 3 to 6 inches—dark brown, very friable sand  
 6 to 15 inches—strong brown, loose sand  
 15 to 30 inches—yellowish brown, loose sand  
 30 to 55 inches—light yellowish brown, loose sand

*Substratum:*  
 55 to 70 inches—yellowish brown sand with bands of sandy clay loam  
 70 to 95 inches—light yellowish brown, stratified sand

**Soil Properties and Qualities**

*Permeability:* Rapid  
*Available water capacity:* Low

*Drainage class:* Alfic Haplorthods—well drained; Entic Haplorthods—excessively drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Alfic Haplorthods—moderate; Entic Haplorthods—severe

*Potential for frost action:* Low

**Composition**

Alfic Haplorthods and similar soils: 40 to 80 percent  
 Entic Haplorthods and similar soils: 20 to 50 percent  
 Contrasting inclusions: 5 to 20 percent

**Inclusions**

*Contrasting inclusions:*

- The very poorly drained Leafriver and Wakeley soils and euc Borosaprists; in depressions and drainageways

*Similar inclusions:*

- Sandy soils that have a fine-loamy substratum
- Sandy soils that do not have a dark brown subsoil

**Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, erosion hazard, seasonal droughtiness, and slope in areas of both soils; plant competition an additional concern in areas of the Alfic Haplorthods

*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The grade should be kept as low as possible.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.
- Carefully managed reforestation helps to control undesirable understory plants.

**Interpretive Groups**

*Land capability classification:* VIIe

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Northern red oak-Red maple-Mapleleaf viburnum

*Secondary plant association:* Mixed oak-Red maple-Starflower

### **235B—Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy, complex, nearly level and undulating**

#### ***Setting***

*Landform:* Moraines

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 200 acres

#### ***Reference Profile***

#### **Alfic Haplorthods, sandy over loamy**

*Organic mat:*

0 to 2 inches—black, partially decomposed hardwood leaf litter

*Surface layer:*

2 to 4 inches—very dark grayish brown sand

*Subsurface layer:*

4 to 6 inches—grayish brown sand

*Subsoil:*

6 to 9 inches—dark brown, very friable loamy sand

9 to 27 inches—strong brown, loose sand

27 to 44 inches—brown, firm sandy clay loam

*Substratum:*

44 to 52 inches—yellowish brown loamy sand

52 to 120 inches—brownish yellow sand

#### **Alfic Haplorthods, sandy**

*Organic mat:*

0 to 2 inches—partially decomposed hardwood leaf litter

*Surface layer:*

2 to 4 inches—very dark gray sand

*Subsurface layer:*

4 to 7 inches—grayish brown sand

*Subsoil:*

7 to 11 inches—dark brown, friable loamy sand

11 to 32 inches—strong brown, very friable sand

32 to 37 inches—yellowish brown, loose sand

37 to 42 inches—dark brown, very friable sandy loam

*Substratum:*

42 to 77 inches—reddish yellow sand

77 to 180 inches—brownish yellow sand

### ***Soil Properties and Qualities***

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 15 feet

*Surface runoff:* Slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Alfic Haplorthods, sandy over loamy—severe; Alfic Haplorthods, sandy—moderate

*Potential for frost action:* Low

#### ***Composition***

Alfic Haplorthods, sandy over loamy, and similar soils: 40 to 70 percent

Alfic Haplorthods, sandy, and similar soils: 20 to 50 percent

Contrasting inclusions: 5 to 20 percent

#### ***Inclusions***

*Contrasting inclusions:*

- The very poorly drained Leafriver and Wakeley soils and euc Borosaprists; in depressions and drainageways
- Eutroboralfs in landscape positions similar to those of the major soils

*Similar inclusions:*

- Sandy soils that do not have a dark brown subsoil
- Sandy soils that do not have loamy textures in the profile

#### ***Use and Management***

*Land use:* Woodland

*Major management concerns:* Plant competition in areas of both soils; equipment limitations, seedling mortality, and seasonal droughtiness additional limitations in areas of the Alfic Haplorthods, sandy over loamy

*Management considerations:*

- Special harvest methods may be needed to control undesirable plants.
- Carefully managed reforestation helps to control undesirable understory plants.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.

### **Interpretive Groups**

*Land capability classification:* IIIs  
*Woodland ordination symbol:* None assigned  
*Michigan soil management group:* None assigned  
*Primary plant association:* Northern red oak-Red maple-Mapleleaf viburnum  
*Secondary plant association:* Northern red oak-Red maple-Trefoil

### **235C—Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy, complex, rolling**

#### **Setting**

*Landform:* Moraines  
*Slope range:* 6 to 18 percent  
*Shape of areas:* Irregular  
*Size of areas:* 20 to 100 acres

#### **Reference Profile**

#### **Alfic Haplorthods, sandy over loamy**

*Organic mat:*  
 0 to 2 inches—black, partially decomposed hardwood leaf litter

*Surface layer:*  
 2 to 4 inches—very dark grayish brown sand

*Subsurface layer:*  
 4 to 6 inches—grayish brown sand

*Subsoil:*  
 6 to 9 inches—dark brown, very friable loamy sand  
 9 to 27 inches—strong brown, friable sand  
 27 to 44 inches—brown, firm sandy clay loam

*Substratum:*  
 44 to 52 inches—yellowish brown loamy sand  
 52 to 120 inches—brownish yellow sand

#### **Alfic Haplorthods, sandy**

*Organic mat:*  
 0 to 2 inches—partially decomposed hardwood leaf litter

*Surface layer:*  
 2 to 4 inches—very dark gray sand

*Subsurface layer:*  
 4 to 7 inches—grayish brown sand

*Subsoil:*  
 7 to 11 inches—dark brown, friable loamy sand  
 11 to 32 inches—strong brown, very friable sand  
 32 to 37 inches—yellowish brown, loose sand  
 37 to 42 inches—dark brown, very friable sandy loam

*Substratum:*  
 42 to 77 inches—reddish yellow sand  
 77 to 180 inches—brownish yellow sand

### **Soil Properties and Qualities**

*Permeability:* Rapid  
*Available water capacity:* Low  
*Drainage class:* Well drained  
*Seasonal high water table:* At a depth of more than 15 feet  
*Surface runoff:* Slow  
*Flooding:* None  
*Hazard of water erosion:* Slight  
*Hazard of soil blowing:* Alfic Haplorthods, sandy over loamy—severe; Alfic Haplorthods, sandy—moderate  
*Potential for frost action:* Low

### **Composition**

Alfic Haplorthods, sandy over loamy, and similar soils: 40 to 70 percent  
 Alfic Haplorthods, sandy, and similar soils: 20 to 50 percent  
 Contrasting inclusions: 5 to 20 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Leafriver and Wakeley soils and euc Borosaprists; in depressions and drainageways
- Eutroboralfs in landscape positions similar to those of the major soils

*Similar inclusions:*

- Sandy soils that do not have a dark brown subsoil
- Sandy soils that have a water table at a depth of 6 to 9 feet
- Sandy soils that do not have loamy textures in the profile

### **Use and Management**

*Land use:* Woodland  
*Major management concerns:* Equipment limitations, seedling mortality, erosion hazard, slope, plant competition  
*Management considerations:*

- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate.
- Areas with a southern exposure may have a higher seedling mortality rate than other areas.

- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

### **Interpretive Groups**

*Land capability classification:* IVe

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Northern red oak-Red maple-Mapleleaf viburnum

*Secondary plant association:* Northern red oak-Red maple-Trefoil

## **236B—Arenic Eutroboralfs, loamy, nearly level and undulating**

### **Setting**

*Landform:* Moraines

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 50 acres

### **Reference Profile**

*Surface layer:*

0 to 2 inches—very dark gray loamy sand

*Subsurface layer:*

2 to 4 inches—light brownish gray sand

*Subsoil:*

4 to 10 inches—dark yellowish brown, friable sand

10 to 30 inches—yellowish brown, friable loamy sand

30 to 35 inches—strong brown, friable sandy loam

*Substratum:*

35 to 45 inches—dark brown sandy clay loam

45 to 70 inches—yellowish brown loamy sand

70 to 100 inches—light yellowish brown, stratified sand

### **Soil Properties and Qualities**

*Permeability:* Rapid over moderate

*Available water capacity:* Low

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Potential for frost action:* Moderate

### **Composition**

Arenic Eutroboralfs and similar soils: 85 to 90 percent

Contrasting inclusions: 10 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Allendale soils
- The very poorly drained, euic Borosaprists in depressions and drainageways

*Similar inclusions:*

- Soils that are moderately well drained
- Soils that have a loamy surface layer
- Soils that have a dark brown subsoil

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Plant competition

*Management considerations:*

- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

### **Interpretive Groups**

*Land capability classification:* IIIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Northern red oak-Red maple-Mapleleaf viburnum

*Secondary plant association:* Northern red oak-Red maple-Trefoil

## **237B—Eutroboralfs, nearly level and undulating**

### **Setting**

*Landform:* Moraines

*Slope range:* 0 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 50 acres

### **Reference Profile**

*Surface layer:*

0 to 3 inches—very dark gray sandy loam

*Subsoil:*

3 to 12 inches—brown and dark brown, friable loamy sand

12 to 29 inches—reddish brown, firm sandy clay loam and brown, friable sandy loam

29 to 43 inches—brown, friable loamy sand

*Substratum:*

43 to 58 inches—reddish brown loamy sand

58 to 84 inches—stratified reddish brown and yellowish brown loam

### **Soil Properties and Qualities**

*Permeability:* Moderate

*Available water capacity:* Moderate

*Drainage class:* Well drained and moderately well drained

*Seasonal high water table:* Apparent, at a depth of 3.5 to 6.0 feet at some time from October through May

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Moderate

*Potential for frost action:* Moderate

### **Composition**

Eutroboralfs and similar soils: 85 to 90 percent

Contrasting inclusions: 10 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The excessively drained, sandy Entic Haplorthods in landscape positions similar to those of the major soils
- The somewhat poorly drained Allendale soils
- The poorly drained Typic Endoaquods
- The very poorly drained, euic Borosaprists in depressions and drainageways

*Similar inclusions:*

- Soils that have a dark subsoil
- Soils that have a surface layer of loamy sand or fine sand

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, plant competition

*Management considerations:*

- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
- Skidders should not be used during wet periods, when ruts form easily.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

### **Interpretive Groups**

*Land capability classification:* None assigned

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Northern red oak-Red maple-Trefoil

*Secondary plant association:* Northern red oak-Red maple-Mapleleaf viburnum

### **237D—Eutroboralfs, hilly**

#### **Setting**

*Landform:* Moraines

*Slope range:* 18 to 30 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 20 acres

#### **Reference Profile**

*Surface layer:*

0 to 3 inches—very dark gray sandy loam

*Subsoil:*

3 to 12 inches—brown and dark brown, friable loamy sand

12 to 29 inches—reddish brown, friable sandy clay loam and brown, friable sandy loam

29 to 43 inches—brown, friable loamy sand

*Substratum:*

43 to 58 inches—reddish brown loamy sand

58 to 84 inches—stratified reddish brown and yellowish brown loam

#### **Soil Properties and Qualities**

*Permeability:* Moderate

*Available water capacity:* Moderate

*Drainage class:* Well drained and moderately well drained

*Seasonal high water table:* Apparent, at a depth of 3.5 to 6.0 feet at some time from October through May

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Moderate

*Potential for frost action:* Moderate

#### **Composition**

Eutroboralfs and similar soils: 70 to 90 percent

Contrasting inclusions: 10 to 30 percent

#### **Inclusions**

*Contrasting inclusions:*

- The excessively drained, sandy Entic Haplorthods in landscape positions similar to those of the major soils
- The somewhat poorly drained Allendale soils
- The poorly drained Typic Endoaquods
- The very poorly drained, euic Borosaprists in depressions and drainageways

*Similar inclusions:*

- Soils that have a dark subsoil
- Soils that have a surface layer of loamy sand or fine sand

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, erosion hazard, slope, plant competition

*Management considerations:*

- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- The grade should be kept as low as possible.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The hazard of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

### **Interpretive Groups**

*Land capability classification:* None assigned

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Northern red oak-Red maple-Trefoil

*Secondary plant association:* Northern red oak-Red maple-Mapleleaf viburnum

### **254A—Borosaprists, euic-Fluvaquents-Aquic Udipsamments complex, nearly level**

#### **Setting**

*Landform:* Outwash plains and flood plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular or linear

*Size of areas:* 10 to 600 acres

#### **Reference Profile**

#### **Borosaprists**

*Surface layer:*

0 to 9 inches—black muck

*Subsoil:*

9 to 15 inches—dark reddish brown, very friable muck

15 to 20 inches—black, very friable muck

20 to 60 inches—gray, loose sand and loamy sand

#### **Fluvaquents**

*Surface layer:*

0 to 3 inches—black muck

3 to 8 inches—very dark gray, mottled loamy sand

*Subsurface layer:*

8 to 15 inches—brown, mottled loamy sand

15 to 38 inches—yellowish brown, mottled sand

*Subsoil:*

38 to 80 inches—pale brown, friable, mottled sand with thin layers of silt, silty clay, and clay

#### **Aquic Udipsamments**

*Surface layer:*

0 to 6 inches—black sand

*Subsoil:*

6 to 22 inches—dark yellowish brown, friable sand

*Substratum:*

22 to 45 inches—yellowish brown sand

45 to 80 inches—brownish yellow sand

### **Soil Properties and Qualities**

*Permeability:* Borosaprists—moderately slow to moderately rapid; Fluvaquents and Aquic Udipsamments—rapid

*Available water capacity:* Borosaprists—high; Fluvaquents—moderate; Aquic Udipsamments—low

*Drainage class:* Borosaprists and Fluvaquents—very poorly drained; Aquic Udipsamments—somewhat poorly drained

*Seasonal high water table:* Borosaprists—apparent, 1 foot above to 1 foot below the surface from September through June; Fluvaquents—apparent, 1 foot above to 1 foot below the surface from October through May; Aquic Udipsamments—apparent, at a depth of 0.5 foot to 1.5 feet from October through May

*Surface runoff:* Borosaprists—very slow or ponded; Fluvaquents and Aquic Udipsamments—very slow

*Flooding:* Common

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Borosaprists and Fluvaquents—moderate; Aquic Udipsamments—severe

*Potential for frost action:* Borosaprists and Fluvaquents—high; Aquic Udipsamments—moderate

### **Composition**

Borosaprists and similar soils: 30 to 50 percent  
 Fluvaquents and similar soils: 30 to 50 percent  
 Aquic Udipsamments and similar soils: 10 to 20 percent  
 Contrasting inclusions: 0 to 20 percent

### **Inclusions**

#### *Contrasting inclusions:*

- The excessively drained, sandy Entic Haplorthods on uplands

#### *Similar inclusions:*

- Sandy soils that have a fine textured substratum
- Organic soils that are acid

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Borosaprists and Fluvaquents—equipment limitations, seedling mortality, plant competition, windthrow hazard; Aquic Udipsamments—equipment limitations, seedling mortality, plant competition, seasonal wetness, seasonal droughtiness

#### *Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Planting when the soil is moist can reduce the seedling mortality rate.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Trees that can withstand seasonal wetness should be selected for planting.
- Selective cutting or cutting in strips and leaving desirable seed trees along the edge of the openings are beneficial for natural regeneration.
- Because of wetness and low strength, harvesting is not recommended.

### **Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* None assigned

*Secondary plant association:* None assigned

## **262A—Au Gres sand, nearly level**

### **Setting**

*Landform:* Outwash plains and sandy lake plains

*Slope range:* 0 to 3 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 300 acres

### **Typical Profile**

*Surface layer:*

0 to 3 inches—black sand

*Subsurface layer:*

3 to 10 inches—pinkish gray sand

*Subsoil:*

10 to 14 inches—dark brown, mottled, loose sand

14 to 27 inches—dark yellowish brown, mottled, loose sand

27 to 33 inches—yellowish brown, mottled, loose sand

*Substratum:*

33 to 80 inches—pale brown, mottled sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Moderate

### **Composition**

Au Gres and similar soils: 70 to 80 percent

Contrasting inclusions: 20 to 30 percent

### **Inclusions**

#### *Contrasting inclusions:*

- The excessively drained, sandy Entic Haplorthods on knolls
- The very poorly drained, dysic Borosaprists in depressions

#### *Similar inclusions:*

- Sandy soils that have a fine textured substratum
- Soils that have an accumulation of organic matter in the surface layer
- Soils that have a cemented subsoil

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

### **Interpretive Groups**

*Land capability classification:* 1Vw

*Woodland ordination symbol:* 6W

*Michigan soil management group:* 5b

*Primary plant association:* Northern red oak-Red maple-Leatherleaf-Blueberry

*Secondary plant association:* Red maple-Balsam fir-Bunchberry

## **263A—Argic Endoaquods, nearly level**

### **Setting**

*Landform:* Outwash plains and lake plains

*Slope range:* 0 to 3 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 100 acres

### **Reference Profile**

*Surface layer:*

0 to 2 inches—black, partially decomposed leaf litter

2 to 5 inches—very dark gray sand

*Subsurface layer:*

5 to 10 inches—light brownish gray sand

*Subsoil:*

10 to 22 inches—strong brown, friable sand

22 to 37 inches—strong brown, friable loamy sand

*Substratum:*

37 to 80 inches—yellowish brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Moderate

### **Composition**

Argic Endoaquods and similar soils: 70 to 80 percent

Contrasting inclusions: 20 to 30 percent

### **Inclusions**

*Contrasting inclusions:*

- The excessively drained, sandy Entic Haplorthods on knolls
- The very poorly drained, dysic Borosaprists in depressions

*Similar inclusions:*

- Sandy soils that have a fine textured substratum
- Soils that have an accumulation of organic matter in the surface layer
- Soils that have a cemented subsoil

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Trees that can withstand seasonal wetness should be selected for planting.
- Planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

### **Interpretive Groups**

*Land capability classification:* None assigned

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Red maple-Balsam fir-Bunchberry

*Secondary plant association:* Northern red oak-Red maple-Leatherleaf-Blueberry

## **264A—Allendale loamy sand, nearly level**

### **Setting**

*Landform:* Outwash plains and lake plains

*Slope range:* 0 to 3 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 40 acres

### **Typical Profile**

*Surface layer:*

0 to 11 inches—very dark grayish brown loamy sand

*Subsurface layer:*

11 to 13 inches—pale brown, mottled sand

*Subsoil:*

13 to 20 inches—dark brown, mottled, very friable sand

20 to 22 inches—yellowish brown, mottled, loose sand

22 to 25 inches—reddish brown, mottled, friable sandy loam

*Substratum:*

25 to 80 inches—reddish brown, mottled, firm silty clay

### **Soil Properties and Qualities**

*Permeability:* Rapid in the sandy part and very slow in the clayey part

*Available water capacity:* Moderate

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Perched at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Potential for frost action:* Moderate

### **Composition**

Allendale soil and similar soils: 70 to 80 percent

Contrasting inclusions: 20 to 30 percent

### **Inclusions**

*Contrasting inclusions:*

- The excessively drained, sandy Entic Haplorthods on knolls

- The very poorly drained, dysic Borosaprists in depressions

*Similar inclusions:*

- Sandy soils that do not have a fine textured substratum
- Soils that have an accumulation of organic matter in the surface layer

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

### **Interpretive Groups**

*Land capability classification:* IIIw

*Woodland ordination symbol:* 4W

*Michigan soil management group:* 4/1b

*Primary plant association:* Mixed ash-Basswood-Downy yellow violet

*Secondary plant association:* Red maple-Balsam fir-Bunchberry

## **265B—Eutroboralfs-Allendale complex, nearly level and undulating**

### **Setting**

*Landform:* Till plains and moraines

*Slope range:* Eutroboralfs—0 to 6 percent; Allendale—0 to 3 percent

*Shape of areas:* Irregular

*Size of areas:* 337 acres

### Typical Profile

#### Eutroboralfs

*Surface layer:*

0 to 3 inches—very dark gray sandy loam

*Subsoil:*

3 to 12 inches—brown and dark brown, friable loamy sand

12 to 29 inches—reddish brown, friable sandy clay loam and brown, friable sandy loam

29 to 43 inches—brown, very friable loamy sand

*Substratum:*

43 to 58 inches—reddish brown loamy sand

58 to 84 inches—stratified reddish brown and yellowish brown loam

#### Allendale

*Surface layer:*

0 to 11 inches—very dark grayish brown loamy sand

*Subsurface layer:*

11 to 13 inches—pale brown, mottled sand

*Subsoil:*

13 to 20 inches—dark brown, mottled, very friable sand

20 to 22 inches—yellowish brown, mottled, loose sand

22 to 25 inches—reddish brown, mottled, friable sandy loam

*Substratum:*

25 to 80 inches—reddish brown, mottled, firm silty clay

### Soil Properties and Qualities

*Permeability:* Eutroboralfs—moderate; Allendale—rapid in the sandy part and very slow in the clayey part

*Available water capacity:* Moderate

*Drainage class:* Eutroboralfs—well drained and moderately well drained; Allendale—somewhat poorly drained

*Seasonal high water table:* Eutroboralfs—apparent, at a depth of 3.5 to 6.0 feet at some time from October through May; Allendale—perched at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Eutroboralfs—medium; Allendale—very slow

*Flooding:* None

*Hazard of water erosion:* Eutroboralfs—moderate; Allendale—slight

*Hazard of soil blowing:* Moderate

*Potential for frost action:* Moderate

### Composition

Eutroboralfs and similar soils: 60 to 80 percent

Allendale soil and similar soils: 10 to 40 percent

Contrasting inclusions: 0 to 10 percent

### Inclusions

*Contrasting inclusions:*

- The excessively drained, sandy Entic Haplorthods on knolls
- The very poorly drained, euic Borosaprists in depressions and drainageways

*Similar inclusions:*

- Areas of the Allendale soil that do not have a fine textured substratum
- Areas of the Allendale soil that have a dark subsoil
- Areas of the Allendale soil that have a surface layer of loamy sand or fine sand

### Use and Management

*Land use:* Woodland

*Major management concerns:* Equipment limitations and plant competition in areas of both soils; seedling mortality, windthrow hazard, and seasonal wetness additional concerns in areas of the Allendale soil

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Special harvest methods may be needed to control undesirable plants.
- Carefully managed reforestation helps to control undesirable understory plants.

### Interpretive Groups

*Land capability classification:* None assigned

*Woodland ordination symbol:* Eutroboralfs—none assigned; Allendale—4W

*Michigan soil management group:* Eutroboralfs—none assigned; Allendale—4/1b

*Primary plant association:* Northern red oak-Red maple-Trefoil

*Secondary plant association:* Red maple-Balsam fir-Bunchberry

## **266A—Typic Duraquods, sandy, nearly level**

### **Setting**

*Landform:* Lake plains and outwash plains

*Slope range:* 0 to 3 percent

*Shape of areas:* Irregular or linear

*Size of areas:* 50 to 1,000 acres

### **Typical Profile**

*Surface layer:*

0 to 3 inches—black, partially decomposed leaf litter

*Subsurface layer:*

3 to 6 inches—gray, mottled sand

6 to 12 inches—light brownish gray, mottled sand

*Subsoil:*

12 to 13 inches—dark reddish brown, strongly cemented, very firm sand

13 to 21 inches—dark reddish brown and black, strongly cemented, very firm sand

21 to 28 inches—yellowish brown, loose, mottled sand

*Substratum:*

28 to 36 inches—yellowish brown, mottled sand

36 to 80 inches—brown sand

### **Soil Properties and Qualities**

*Permeability:* Moderately rapid

*Available water capacity:* Low

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Potential for frost action:* Moderate

### **Composition**

Typic Duraquods and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained Croswell soils on ridges

- The very poorly drained, euic Borosapristis in small depressions and drainageways

*Similar inclusions:*

- Soils that have a lighter colored subsoil
- Soils that do not have a cemented subsoil
- Soils that have clay material below a depth of 40 inches

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, plant competition, seedling mortality, windthrow hazard, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Planting when the soil is moist can reduce the seedling mortality rate.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Planting when the soil is moist can reduce the seedling mortality rate.

### **Interpretive Groups**

*Land capability classification:* IVw

*Woodland ordination symbol:* 4W

*Michigan soil management group:* 5b-h

*Primary plant association:* Northern red oak-Red maple-Leatherleaf-Blueberry

*Secondary plant association:* Red maple-Balsam fir-Bunchberry

## **272—Endoaquods-Fluvaquents complex**

### **Setting**

*Landform:* Outwash plains, deltas, and flood plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 200 acres

### Reference Profile

#### Endoaquods

*Surface layer:*

0 to 2 inches—black sand

*Subsurface layer:*

2 to 8 inches—dark grayish brown, mottled sand

*Subsoil:*

8 to 19 inches—dark brown and dark yellowish brown, mottled, very friable sand

*Substratum:*

19 to 48 inches—yellowish brown, mottled loamy sand  
48 to 80 inches—olive brown sand

#### Fluvaquents

*Surface layer:*

0 to 3 inches—black muck  
3 to 8 inches—very dark gray, mottled loamy sand

*Subsurface layer:*

8 to 15 inches—brown, mottled loamy sand  
15 to 38 inches—yellowish brown, mottled sand

*Subsoil:*

38 to 80 inches—pale brown, mottled, friable sand with thin layers of silt, silty clay, and clay

### Soil Properties and Qualities

*Permeability:* Rapid

*Available water capacity:* Endoaquods—low;  
Fluvaquents—moderate

*Drainage class:* Very poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* Endoaquods—none; Fluvaquents—common

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Endoaquods—severe;  
Fluvaquents—moderate

*Potential for frost action:* Endoaquods—moderate;  
Fluvaquents—high

### Composition

Endoaquods and similar soils: 40 to 60 percent

Fluvaquents and similar soils: 40 to 60 percent

Contrasting inclusions: 20 to 35 percent

### Inclusions

*Contrasting inclusions:*

- The excessively drained, sandy Entic Haplorthods on knolls
- The very poorly drained, euic Borosaprists in depressions

- The very poorly drained, dysic Borosaprists in depressions

*Similar inclusions:*

- Sandy soils that have a fine textured substratum
- Soils that have more accumulation of organic matter in the surface layer
- Soils that have finer textured surface horizons
- Soils that have a cemented subsoil

### Use and Management

*Land use:* Woodland

*Major management concerns:* Equipment limitations, windthrow hazard, seedling mortality, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

### Interpretive Groups

*Land capability classification:* None assigned

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Northern red oak-Red maple-Leatherleaf-Blueberry

*Secondary plant association:* Red maple-Balsam fir-Bunchberry

### 273—Leafriver-Wakeley complex

#### Setting

*Landform:* Outwash plains and lake plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 200 acres

### Typical Profile

#### Leafriver

*Surface layer:*

0 to 9 inches—black muck

*Substratum:*

9 to 21 inches—brown and dark brownish gray sand

21 to 27 inches—grayish brown, mottled sand

27 to 80 inches—dark grayish brown sand

#### Wakeley

*Surface layer:*

0 to 6 inches—black, mottled mucky sand

*Substratum:*

6 to 12 inches—gray sand

12 to 24 inches—grayish brown, mottled sand

24 to 29 inches—grayish brown, mottled, stratified sand and loamy sand

29 to 34 inches—pinkish gray, mottled clay

34 to 80 inches—pinkish gray, mottled, stratified clay and silty clay

### Soil Properties and Qualities

*Permeability:* Leafriver—rapid; Wakeley—rapid in the sandy part and very slow in the clayey part

*Available water capacity:* Moderate

*Drainage class:* Very poorly drained

*Seasonal high water table:* Leafriver—apparent, 1 foot above to 1 foot below the surface from November through July; Wakeley—perched 1 foot above to 1 foot below the surface from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Leafriver—moderate; Wakeley—severe

*Potential for frost action:* Leafriver—high; Wakeley—moderate

### Composition

Leafriver and similar soils: 40 to 60 percent

Wakeley and similar soils: 40 to 60 percent

Contrasting inclusions: 10 to 20 percent

### Inclusions

*Contrasting inclusions:*

- The moderately well drained, sandy Entic Haplorthods on knolls
- The very poorly drained, dysic Borosaprists in depressions

*Similar inclusions:*

- Sandy soils that have fine textured surface horizons

- Soils that have a thick accumulation of organic matter

### Use and Management

*Land use:* Woodland

*Major management concerns:* Equipment limitations, windthrow hazard, seedling mortality, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Because of the wetness and low strength, harvesting is not recommended in areas of organic soils.

### Interpretive Groups

*Land capability classification:* Vlw

*Woodland ordination symbol:* Leafriver—2W; Wakeley—3W

*Michigan soil management group:* Leafriver—5c; Wakeley—4/1c

*Primary plant association:* Red maple-Balsam fir-Bunchberry

*Secondary plant association:* Northern red oak-Red maple-Leatherleaf-Blueberry

### 274—Typic Endoaquods

#### Setting

*Landform:* Outwash plains and lake plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 100 acres

### Reference Profile

*Surface layer:*

0 to 2 inches—black mucky sand

*Subsurface layer:*

2 to 5 inches—grayish brown, mottled sand

**Subsoil:**

5 to 8 inches—dark brown, mottled, friable sand  
8 to 15 inches—strong brown, mottled, very friable sand

**Substratum:**

15 to 80 inches—brown, mottled sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Very poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Potential for frost action:* Moderate

**Composition**

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

**Inclusions****Contrasting inclusions:**

- The moderately well drained, sandy Entic Haplorthods on knolls
- The very poorly drained, dysic Borosaprists in depressions

**Similar inclusions:**

- Poorly drained soils that have sandy textures

**Use and Management**

*Land use:* Woodland

*Major management concerns:* Equipment limitations, windthrow hazard, seedling mortality, plant competition, seasonal wetness

**Management considerations:**

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Trees that can withstand seasonal wetness should be selected for planting.
- Because loose sand can interfere with the traction of

wheeled equipment, logging roads should be stabilized.

- Planting when the soil is moist can reduce the seedling mortality rate.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

**Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Mixed ash-Basswood-Downy yellow violet

*Secondary plant association:* Northern whitecedar-Eastern hemlock-Canada violet

**280—Aquepts and Histosols, ponded****Setting**

*Landform:* Outwash plains and flood plains

*Slope range:* 0 to 1 percent

*Shape of areas:* Oval or irregular

*Size of areas:* 5 to 100 acres

**Reference Profile****Aquepts**

0 to 80 inches—variable

**Histosols**

0 to 60 inches—black muck

60 to 80 inches—gray sand

**Soil Properties and Qualities**

*Permeability:* Moderately rapid to moderately slow

*Available water capacity:* Aquepts—low; Histosols—high

*Drainage class:* Very poorly drained

*Seasonal high water table:* Apparent, at the surface to 1 foot above the surface from January through December

*Surface runoff:* Ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Aquepts—none assigned; Histosols—moderate

*Potential for frost action:* High

**Composition**

Aquepts: 50 to 70 percent

Histosols: 30 to 40 percent  
 Contrasting inclusions: 0 to 10 percent

### ***Inclusions***

*Contrasting inclusions:*

- Small areas of somewhat poorly drained soils at the edges of the unit
- Small areas of open water

### ***Use and Management***

*Land use:* Wetland wildlife habitat

*Major management concerns:* Onsite investigation is needed to determine the suitability for specific uses.

### ***Interpretive Groups***

*Land capability classification:* None assigned

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* None assigned

*Secondary plant association:* None assigned

## **281—Borosaprists, dysic**

### ***Setting***

*Landform:* Shallow closed depressions on outwash and lake plains and flood plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Oval

*Size of areas:* 5 to 100 acres

### ***Reference Profile***

*Surface layer:*

0 to 13 inches—dark reddish brown mucky peat

*Subsoil:*

13 to 25 inches—black, friable muck

*Substratum:*

25 to 80 inches—dark grayish brown and yellowish brown sand

### ***Soil Properties and Qualities***

*Permeability:* Moderately slow to moderately rapid in the mucky part and rapid in the sandy part

*Available water capacity:* High

*Drainage class:* Very poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from September through June

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Slight

*Potential for frost action:* High

### ***Composition***

Borosaprists: 90 to 100 percent

Contrasting inclusions: 0 to 10 percent

### ***Inclusions***

*Contrasting inclusions:*

- Poorly drained, sandy soils on knolls and ridges

*Similar inclusions:*

- Soils that have less than 16 inches of organic material

### ***Use and Management***

*Land use:* Woodland

*Major management concerns:* Wetness

*Management considerations:*

- Because of wetness and low strength, management of this unit is not recommended.

### ***Interpretive Groups***

*Land capability classification:* VIIw

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Black spruce-Tamarack-Labrador tea

*Secondary plant association:* None assigned

## **282—Borosaprists, euic**

### ***Setting***

*Landform:* Depressions on moraines, till plains, and alluvial plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 200 acres

### ***Reference Profile***

*Surface layer:*

0 to 9 inches—black muck

*Subsoil:*

9 to 38 inches—dark reddish brown muck

38 to 51 inches—black muck

### ***Soil Properties and Qualities***

*Permeability:* Moderately slow to moderately rapid

*Available water capacity:* High

*Drainage class:* Very poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from September through June

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight  
*Hazard of soil blowing:* Moderate  
*Potential for frost action:* High

### **Composition**

Borosaprists: 90 to 100 percent  
 Contrasting inclusions: 0 to 10 percent

### **Inclusions**

#### *Contrasting inclusions:*

- Dysic Borosaprists in landscape positions similar to those of the major soils
- The somewhat poorly drained Au Gres soils on knolls and ridges

#### *Similar inclusions:*

- Soils that have sandy material below a depth of 16 inches
- Soils that have loamy or clayey material below a depth of 16 inches
- Soils that have a higher fiber content in the subsoil

### **Use and Management**

*Land use:* Woodland

*Major management concerns:* Wetness

*Management considerations:*

- Because of wetness and low strength, management of this unit is not recommended.

### **Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

*Primary plant association:* Northern whitecedar-  
 Eastern hemlock-Canada violet

*Secondary plant association:* Mixed ash-Basswood-  
 Downy yellow violet

## **343—Sims loam, drained**

### **Setting**

*Landform:* Till plains and moraines

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 5 to 100 acres

### **Typical Profile**

*Surface layer:*

0 to 5 inches—black loam

*Subsoil:*

5 to 47 inches—dark gray and gray, mottled, firm clay loam

*Substratum:*

47 to 80 inches—light reddish brown, mottled clay loam

## **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* High

*Drainage class:* Poorly drained

*Seasonal high water table:* Perched 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* Moderate

*Potential for frost action:* High

### **Composition**

Sims soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

#### *Contrasting inclusions:*

- The poorly drained, sandy over loamy Caffey soils
- The somewhat poorly drained Kawkawlin soils
- The very poorly drained Deford soils

#### *Similar inclusions:*

- Soils that have a surface layer of sandy loam
- Soils that have sand below a depth of 40 inches

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture

#### **Cropland**

*Major management concerns:* Restricted permeability, soil compaction, tith in the surface layer, seasonal wetness, ponding

*Management considerations:*

- Both surface and subsurface drainage systems are needed to reduce the wetness.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tith.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.

#### **Pasture**

*Major management concerns:* Compaction, seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system,

and deferred grazing during wet periods help to keep the pasture in good condition.

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

### **Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

### **Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* IIw

*Woodland ordination symbol:* 4W

*Michigan soil management group:* 1.5c

## **355E—Crowell-Proper complex, 4 to 25 percent slopes**

### **Setting**

*Landform:* Dune ridges on lake plains

*Slope range:* Crowell—8 to 25 percent; Proper—4 to 8 percent

*Shape of areas:* Linear

*Size of areas:* 10 to 100 acres

### **Typical Profile**

#### **Crowell**

*Surface layer:*

0 to 4 inches—black sand

*Subsurface layer:*

4 to 8 inches—light brownish gray sand

*Subsoil:*

8 to 17 inches—dark brown, very friable sand

17 to 22 inches—yellowish brown, loose sand with columns of dark reddish brown, strongly cemented sand

22 to 34 inches—strong brown, loose sand with columns of dark reddish brown, strongly cemented sand

34 to 52 inches—brownish yellow, loose sand

*Substratum:*

52 to 80 inches—very pale brown sand

#### **Proper**

*Surface layer:*

0 to 2 inches—black, partially decomposed leaf litter

*Subsurface layer:*

2 to 12 inches—dark grayish brown and grayish brown sand

*Subsoil:*

12 to 19 inches—dark brown, very friable sand with columns of strongly cemented sand

19 to 26 inches—brownish yellow, loose sand with columns of weakly cemented sand

26 to 40 inches—brownish yellow, mottled, loose sand with columns of weakly cemented sand

*Substratum:*

40 to 80 inches—pale brown and light yellowish brown, mottled sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Crowell—somewhat excessively drained; Proper—moderately well drained

*Seasonal high water table:* Crowell—at a depth of more than 6 feet; Proper—apparent, at a depth of 2.0 to 3.5 feet at some time from November through May

*Surface runoff:* Crowell—medium or slow; Proper—slow or very slow

*Flooding:* None

*Hazard of water erosion:* Crowell—moderate; Proper—slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

### **Composition**

Crowell soil and similar soils: 40 to 50 percent

Proper soil and similar soils: 40 to 50 percent

Contrasting inclusions: 0 to 20 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained McIvor soils
- The very poorly drained Wabun soils
- The very poorly drained Kanotin soils

*Similar inclusions:*

- Soils that do not have a cemented subsoil
- Soils that have a darker subsoil

## **Use and Management**

*Dominant land use:* Woodland

### **Woodland**

*Major management concerns:* Crowell—equipment limitations, seedling mortality, seasonal droughtiness, erosion hazard, slope; Proper—equipment limitations, seedling mortality, seasonal droughtiness, plant competition, windthrow

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- The grade should be kept as low as possible.
- Areas sensitive to erosion, esthetic considerations, and drought conditions may require mulch, such as straw, bark, or wood chips.
- Planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate. Replanting is needed in some areas.
- In areas of the Proper soil, windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants in areas of the Proper soil.
- Special harvest methods may be needed to control undesirable plants in areas of the Proper soil.

### **Building sites**

*Major management concerns:* Crowell—cutbanks caving, slope; Proper—cutbanks caving, seasonal wetness

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Because of the slope, the Crowell soil is poorly suited to building site development unless extensive land shaping is feasible.
- Wetness in areas of the Proper soil can be reduced by installing a drainage system around structures with basements and crawl spaces.
- In areas of the Proper soil, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

### **Septic tank absorption fields**

*Major management concerns:* Crowell—rapid permeability, slope; Proper—rapid permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of these soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table in areas of the Proper soil.
- A subsurface drainage system helps to lower the water table in areas of the Proper soil.
- Because of the slope, the Crowell soil is generally unsuited to septic tank absorption fields.

## **Interpretive Groups**

*Land capability classification:* VIIs

*Woodland ordination symbol:* Crowell—7R; Proper—5W

*Michigan soil management group:* 5a-h

## **356E—Aquepts-Histosols-Fluvaquents complex, nearly level to very steep**

### **Setting**

*Landform:* Narrow flood plains and adjacent steep side slopes on till plains, lake plains, and outwash plains

*Slope range:* Aquepts—4 to 35 percent; Histosols—0 to 2 percent; Fluvaquents—0 to 4 percent

*Shape of areas:* Linear

*Size of areas:* 20 to 500 acres

### **Typical Profile**

#### **Aquepts**

*Surface layer:*

0 to 3 inches—very dark grayish brown fine sandy loam

*Subsoil:*

3 to 15 inches—brown, friable fine sandy loam

*Substratum:*

15 to 80 inches—dark reddish brown clay loam

#### **Histosols**

*Surface layer:*

0 to 6 inches—black muck

*Subsoil:*

6 to 25 inches—black, very friable muck

**Substratum:**

25 to 80 inches—textures ranging from sand to loam to clay

**Fluvaquents****Surface layer:**

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

**Subsoil:**

6 to 21 inches—brown, mottled, friable sandy loam

**Substratum:**

21 to 42 inches—brown, mottled sandy loam  
42 to 80 inches—pale brown, mottled, stratified sand and very fine sandy loam

**Soil Properties and Qualities**

**Permeability:** Aquepts—slow; Histosols—moderately slow to moderately rapid; Fluvaquents—rapid

**Available water capacity:** Aquepts—moderate; Histosols—high; Fluvaquents—moderate

**Drainage class:** Aquepts—somewhat poorly drained; Histosols—very poorly drained; Fluvaquents—poorly drained

**Seasonal high water table:** Aquepts—perched at a depth of 0.5 foot to 2.5 feet at some time from October through May; Histosols and Fluvaquents—apparent, 1 foot above to 1 foot below the surface at some time from October through May

**Surface runoff:** Aquepts—rapid; Histosols and Fluvaquents—very slow or ponded

**Flooding:** Aquepts and Histosols—none; Fluvaquents—common

**Hazard of water erosion:** Aquepts—severe; Histosols and Fluvaquents—slight

**Hazard of soil blowing:** Moderate

**Potential for frost action:** Aquepts—moderate; Histosols—high; Fluvaquents—moderate

**Composition**

Aquepts and similar soils: 20 to 30 percent  
Histosols and similar soils: 20 to 30 percent  
Fluvaquents and similar soils: 15 to 25 percent  
Contrasting inclusions: 15 to 25 percent

**Inclusions****Contrasting inclusions:**

- The excessively drained Rubicon soils
- The well drained Curtisville soils

**Similar inclusions:**

- Soils that have clay in the subsoil
- Soils that have silt in the subsoil
- The somewhat poorly drained Winterfield soils

**Use and Management**

**Dominant land use:** Wildlife areas

**Management considerations:**

- This unit is unsuitable for most uses. Onsite investigation is needed to determine the suitability for any specific uses.

**Interpretive Groups**

**Land capability classification:** None assigned

**Woodland ordination symbol:** None assigned

**Michigan soil management group:** Histosols—Mc; Aquepts and Fluvaquents—none assigned

**357B—Udipsamments-Urban land complex, 0 to 8 percent slopes****Setting**

**Landform:** Outwash plains and lake terraces

**Shape of areas:** Irregular

**Size of areas:** 3,658 acres

**Typical Profile****Udipsamments****Surface layer:**

0 to 6 inches—black sand

**Subsoil:**

6 to 30 inches—yellowish brown, very friable sand  
30 to 50 inches—brownish yellow, loose sand

**Substratum:**

50 to 80 inches—yellow sand

**Soil Properties and Qualities****Udipsamments**

**Permeability:** Rapid

**Available water capacity:** Very low

**Drainage class:** Excessively drained

**Seasonal high water table:** At a depth of more than 6 feet

**Surface runoff:** Slow

**Flooding:** None

**Hazard of water erosion:** Slight

**Hazard of soil blowing:** Severe

**Shrink-swell potential:** Low

**Potential for frost action:** Low

**Composition**

Udipsamments and similar soils: 50 to 70 percent

Urban land: 30 to 50 percent

Contrasting inclusions: 0 to 20 percent

### **Inclusions**

#### *Contrasting inclusions:*

- The very poorly drained Deford soils

#### *Similar inclusions:*

- Soils that have fine sand in the profile
- Soils that have a darker subsoil
- Soils that have stratified very fine sand and silt in the substratum

### **Use and Management**

*Dominant land use:* Udipsamments—gardens, lawns, building sites, idle land; Urban land—streets, parking lots, sites for buildings and other structures

#### **Gardens, lawns, and environmental plantings**

*Major management concerns:* Low available water capacity, soil blowing

#### *Management considerations*

- Irrigation may be needed to maintain lawns and gardens.
- Perennial plants that can withstand droughtiness should be selected for planting.
- A good plant cover and mulch can help to control soil blowing.

#### **Building sites**

*Major management concerns:* Udipsamments—cutbanks caving

#### *Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

#### **Septic tank absorption fields**

*Major management concerns:* Udipsamments—rapid permeability

#### *Management considerations:*

- The poor filtering capacity of these soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Sanitary facilities should be connected to public sewers and sewage treatment facilities.

### **Interpretive Groups**

*Land capability classification:* Udipsamments—VIIs

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

## **360—Wakeley muck**

### **Setting**

*Landform:* Lake plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 5 to 50 acres

### **Typical Profile**

*Surface layer:*

0 to 5 inches—black muck

*Substratum:*

5 to 16 inches—dark grayish brown and grayish brown, mottled sand

16 to 27 inches—brown, mottled sand

27 to 80 inches—reddish brown and pinkish gray, mottled clay

### **Soil Properties and Qualities**

*Permeability:* Rapid in the sandy part and very slow in the clayey part

*Available water capacity:* Moderate

*Drainage class:* Very poorly drained

*Seasonal high water table:* Perched 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* High

*Potential for frost action:* Moderate

### **Composition**

Wakeley soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

#### *Contrasting inclusions:*

- The very poorly drained, sandy Leafriver soils
- The somewhat poorly drained Allendale soils

#### *Similar inclusions:*

- Soils that have thinner layers of sand
- Soils that have clay below a depth of 40 inches

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Pasture

#### **Pasture**

*Major management concerns:* Seasonal wetness, overgrazing

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.
- Applying lime and fertilizer according to soil tests can help to ensure the maximum growth of plants.

**Woodland**

*Major management concerns:* Equipment limitations, plant competition, seasonal wetness, seedling mortality, windthrow hazard

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.
- Selective cutting or cutting in strips and leaving desirable seed trees along the edge of the openings are beneficial for natural regeneration.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

**Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

**Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

**Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* 3W

*Michigan soil management group:* 4/1c

**367A—Whittemore-Springport complex, 0 to 3 percent slopes****Setting**

*Landform:* Lake plains (fig. 10)

*Slope range:* Whittemore—0 to 3 percent;  
Springport—0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 500 acres

**Typical Profile****Whittemore**

*Surface layer:*

0 to 9 inches—very dark gray sand

*Subsurface layer:*

9 to 12 inches—light grayish brown and light gray sand

*Subsoil:*

12 to 17 inches—dark reddish brown, mottled, strongly cemented, firm sand

17 to 35 inches—yellowish brown and light yellowish brown, mottled, loose sand

35 to 44 inches—light reddish brown, mottled, firm silty clay

*Substratum:*

44 to 80 inches—reddish brown, mottled silty clay

**Springport**

*Surface layer:*

0 to 10 inches—very dark gray silty clay loam

*Subsoil:*

10 to 36 inches—dark gray and gray, mottled, firm silty clay loam

*Substratum:*

36 to 50 inches—reddish brown, mottled silty clay loam

50 to 80 inches—reddish brown, mottled silt loam

**Soil Properties and Qualities**

*Permeability:* Whittemore—moderately rapid in the sandy part and very slow in the clayey part;  
Springport—very slow

*Available water capacity:* Whittemore—low;  
Springport—high

*Drainage class:* Whittemore—somewhat poorly drained;  
Springport—poorly drained

*Seasonal high water table:* Whittemore—perched at a depth of 0.5 foot to 1.5 feet at some time from October through May; Springport—perched 1 foot above to 1 foot below the surface at some time from October through June

*Surface runoff:* Whittemore—very slow; Springport—very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Whittemore—severe;  
Springport—moderate

*Shrink-swell potential:* High

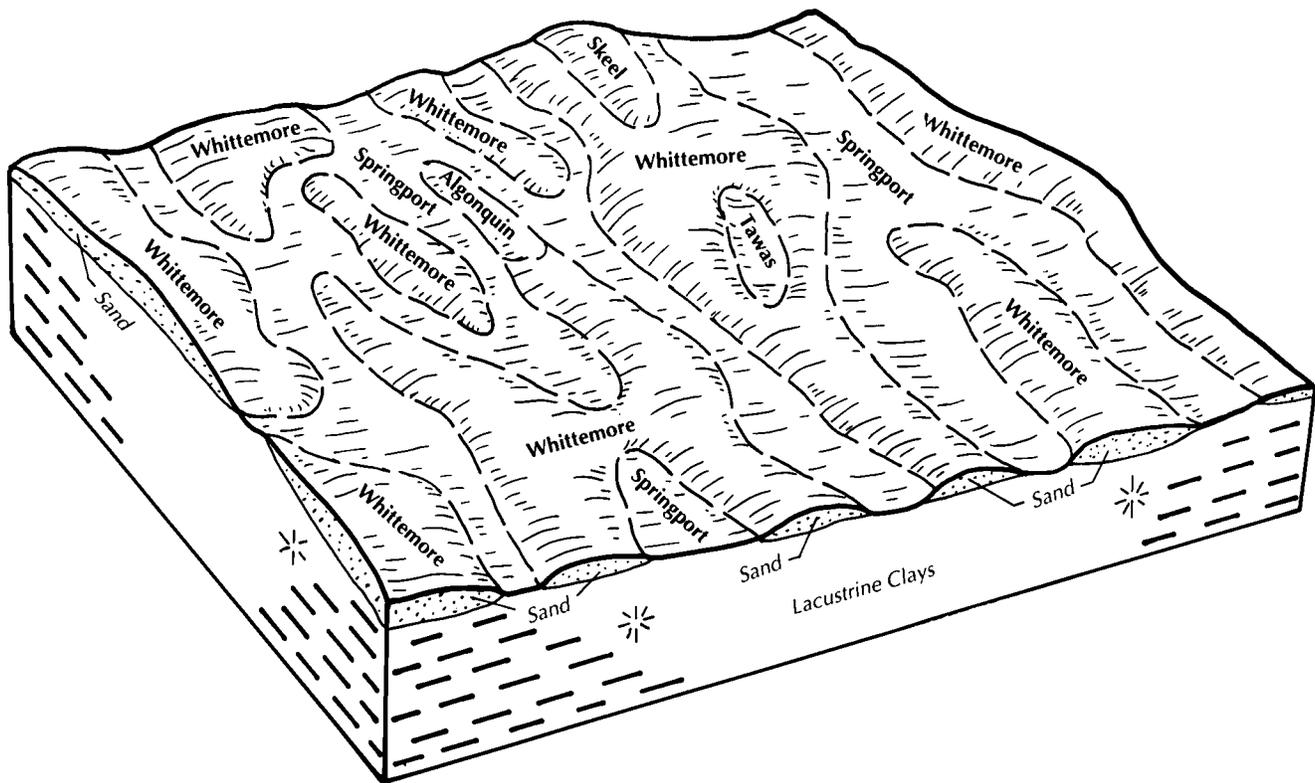


Figure 10.—Typical pattern of soils on the landscape in an area of Whittemore-Springport complex, 0 to 3 percent slopes.

*Potential for frost action:* Whittemore—high;  
Springport—high

### **Composition**

Whittemore soil and similar soils: 50 to 60 percent  
Springport soil and similar soils: 30 to 40 percent  
Contrasting inclusions: 0 to 20 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained, clayey Algonquin soils
- The moderately well drained Skeel soils
- The very poorly drained Tawas soils

*Similar inclusions:*

- Sandy soils that have a lighter colored subsoil
- Loamy soils that have a mucky surface layer
- Sandy soils that contain less than 50 percent ortstein in the subsoil

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Cropland, pasture

### **Cropland**

*Major management concerns:* Whittemore—seasonal wetness, restricted permeability, soil blowing, nutrient and pesticide loss; Springport—seasonal wetness, restricted permeability, tilth of the surface layer, soil compaction

*Management considerations:*

- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Shallow surface ditches help to remove surface water after heavy rains.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Conservation tillage, windbreaks, crop residue management, strip cropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing in areas of the Whittemore soil. Maintaining a permanent plant cover also helps to control soil blowing.

- Because of the risk of ground-water pollution in areas of the Whittemore soil, nutrients in manure and fertilizer applications should not exceed the requirements of the plants.

### Pasture

*Major management concerns:* Whittemore—seasonal wetness; Springport—seasonal wetness, compaction

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth in areas of the Springport soil.

### Woodland

*Major management concerns:* Equipment limitations, plant competition, seedling mortality, windthrow hazard, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Trees that can withstand seasonal wetness should be selected for planting in areas of the Whittemore soil.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted in areas of the Springport soil.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

### Building sites

*Major management concerns:* Whittemore—cutbanks caving, seasonal wetness, shrink-swell; Springport—ponding

*Management considerations:*

- Because cutbanks in areas of the Whittemore soil are not stable and are subject to caving, trench walls should be reinforced.
- In areas of the Whittemore soil, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- In areas of the Whittemore soil, wetness can be

reduced by installing a drainage system around structures with basements and crawl spaces.

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling in areas of the Whittemore soil.
- Because of ponding, the Springport soil is generally unsuited to building site development.

### Septic tank absorption fields

*Major management concerns:* Whittemore—seasonal wetness, rapid permeability, restricted permeability; Springport—ponding

*Management considerations:*

- The poor filtering capacity of the Whittemore soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- In areas of the Whittemore soil, filling or mounding with suitable fill material helps to raise the absorption field above the water table.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability of the Whittemore soil.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability of the Whittemore soil.
- Because of ponding, the Springport soil is generally unsuited to septic tank absorption fields.

### Interpretive Groups

*Land capability classification:* IIIw

*Woodland ordination symbol:* Whittemore—4W; Springport—6W

*Michigan soil management group:* Whittemore—5/2b; Springport—1c

## 368A—Au Gres-Deford complex, 0 to 3 percent slopes

### Setting

*Landform:* Lake plains, moraines, deltas, and outwash plains

*Slope range:* Au Gres—0 to 3 percent; Deford—0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 50 to 800 acres

### Typical Profile

#### Au Gres

*Surface layer:*

0 to 3 inches—black, partially decomposed leaf litter

*Subsurface layer:*

3 to 9 inches—pinkish gray, mottled sand

*Subsoil:*

9 to 14 inches—dark reddish brown and dark brown, mottled, very friable sand

14 to 29 inches—yellowish brown, mottled, loose sand

*Substratum:*

29 to 80 inches—very pale brown sand

**Deford***Surface layer:*

0 to 5 inches—black muck

*Substratum:*

5 to 21 inches—light brownish gray, mottled sand

21 to 42 inches—pale brown and grayish brown fine sand

42 to 80 inches—grayish brown sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Au Gres—somewhat poorly drained; Deford—very poorly drained

*Seasonal high water table:* Au Gres—apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May; Deford—apparent, 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Au Gres—very slow; Deford—very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Au Gres—severe; Deford—moderate

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

**Composition**

Au Gres soil and similar soils: 60 to 70 percent

Deford soil and similar soils: 15 to 30 percent

Contrasting inclusions: 0 to 25 percent

**Inclusions***Contrasting inclusions:*

- The excessively drained Grayling soils
- The very poorly drained Tawas soils that have more than 16 inches of muck at the surface

*Similar inclusions:*

- Very poorly drained soils that have a surface layer of sand
- Soils that have a lighter colored subsoil
- Soils that have clay below a depth of 40 inches

**Use and Management**

*Dominant land use:* Woodland

*Other uses:* Pasture

**Pasture**

*Major management concerns:* Au Gres—seasonal wetness, seasonal droughtiness; Deford—seasonal wetness

*Management considerations:*

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to soil tests can help to ensure the maximum growth of plants.

**Woodland**

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition, seedling mortality, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Trees that can withstand seasonal wetness should be selected for planting in areas of the Au Gres soil.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted in areas of the Deford soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

**Building sites**

*Major management concerns:* Au Gres—cutbanks caving, seasonal wetness; Deford—ponding

*Management considerations:*

- Because cutbanks in areas of the Au Gres soil are not stable and are subject to caving, trench walls should be reinforced.
- In areas of the Au Gres soil, wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- In areas of the Au Gres soil, buildings can be constructed on well compacted fill material, which

raises the site a sufficient distance above the water table.

- Because of ponding, the Deford soil is generally unsuited to building site development.

### **Septic tank absorption fields**

*Major management concerns:* Au Gres—rapid permeability, seasonal wetness; Deford—ponding

*Management considerations:*

- The poor filtering capacity of the Au Gres soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable fill material helps to raise the absorption field above the water table in areas of the Au Gres soil.
- Because of ponding, the Deford soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* Au Gres—6W; Deford—4W

*Michigan soil management group:* Au Gres—5b; Deford—4c

## **369—Deford muck**

### **Setting**

*Landform:* Lake plains, deltas, moraines, and outwash plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular or linear

*Size of areas:* 3 to 200 acres

### **Typical Profile**

*Surface layer:*

0 to 5 inches—black muck

*Substratum:*

5 to 21 inches—light brownish gray, mottled sand

21 to 42 inches—pale brown and grayish brown fine sand

42 to 80 inches—grayish brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Very poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

### **Composition**

Deford soil and similar soils: 90 to 95 percent

Contrasting inclusions: 5 to 10 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Tawas soils that have more than 16 inches of muck at the surface
- The somewhat poorly drained Au Gres soils
- The somewhat poorly drained Finch soils

*Similar inclusions:*

- Soils that have strata of coarse sand in the substratum
- Soils that have a surface layer of sand
- Soils that have clay below a depth of 40 inches

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Pasture

#### **Pasture**

*Major management concerns:* Seasonal wetness, overgrazing

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.

#### **Woodland**

*Major management concerns:* Plant competition, seedling mortality, equipment limitations, windthrow hazard, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

**Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

**Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

**Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* 4W

*Michigan soil management group:* 4c

**370A—Mclvor sand, 0 to 3 percent slopes****Setting**

*Landform:* Lake plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 250 acres

**Typical Profile**

*Surface layer:*

0 to 2 inches—undecomposed leaf litter

*Subsurface layer:*

2 to 4 inches—dark gray sand

4 to 10 inches—pinkish gray sand

10 to 20 inches—pinkish gray and white, mottled sand

*Subsoil:*

20 to 26 inches—dark reddish brown and yellowish brown, mottled, firm, weakly to strongly cemented sand

26 to 31 inches—dark yellowish brown, mottled, loose sand

*Substratum:*

31 to 58 inches—pale brown sand

58 to 80 inches—reddish brown silty clay

**Soil Properties and Qualities**

*Permeability:* Moderately rapid in the sandy part and very slow in the clayey part

*Available water capacity:* Low

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Perched at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

**Composition**

Mclvor soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

**Inclusions**

*Contrasting inclusions:*

- The moderately well drained Proper soils
- The very poorly drained Tawas soils
- The very poorly drained Wabun soils

*Similar inclusions:*

- Soils that have a silty clay substratum within a depth of 40 inches
- Soils that do not have cementation in the subsoil
- Soils that do not have clay in the substratum

**Use and Management**

*Dominant land use:* Woodland

*Other uses:* Pasture

**Pasture**

*Major management concerns:* Seasonal wetness, seasonal droughtiness, overgrazing

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

**Woodland**

*Major management concerns:* Equipment limitations, plant competition, seedling mortality, windthrow hazard, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

- Carefully managed reforestation helps to control undesirable understory plants.

### **Building sites**

*Major management concerns:* Cutbanks caving, seasonal wetness

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

### **Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, rapid permeability, restricted permeability

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IVw

*Woodland ordination symbol:* 2W

*Michigan soil management group:* 5b-h

## **371—Springport silt loam**

### **Setting**

*Landform:* Lake plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 100 acres

### **Typical Profile**

*Surface layer:*

0 to 11 inches—very dark gray silt loam

*Subsoil:*

11 to 27 inches—grayish brown, mottled, firm silty clay

*Substratum:*

27 to 80 inches—pinkish gray, mottled silty clay

### **Soil Properties and Qualities**

*Permeability:* Very slow

*Available water capacity:* High

*Drainage class:* Poorly drained

*Seasonal high water table:* Perched 1 foot above to 1 foot below the surface at some time from October through June

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* High

*Potential for frost action:* High

### **Composition**

Springport soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Whittemore soils
- The somewhat poorly drained Algonquin soils

*Similar inclusions:*

- Soils that have a mucky surface layer
- Soils that have a surface layer of sandy loam
- Soils that have sand below a depth of 60 inches

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Pasture, cropland

### **Cropland**

*Major management concerns:* Seasonal wetness, tilth in the surface layer, soil compaction, restricted permeability, ponding

*Management considerations:*

- Shallow surface ditches help to remove surface water after heavy rains.
- Both surface and subsurface drainage systems are needed to reduce the wetness.
- Subsurface drains can be used if a suitable outlet is available.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Minimizing tillage and tilling and harvesting at the

proper soil moisture content help to prevent excessive compaction and maintain tilth.

### Pasture

*Major management concerns:* Seasonal wetness, compaction

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

### Woodland

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Because of the restricted permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.
- Skidders should not be used during wet periods, when ruts form easily.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

### Building sites

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

### Septic tank absorption fields

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

### Interpretive Groups

*Land capability classification:* Vw

*Woodland ordination symbol:* 6W

*Michigan soil management group:* 1c

## 372B—Proper-Leafriver complex, 0 to 6 percent slopes

### Setting

*Landform:* Beach ridges on lake plains

*Slope range:* Proper—0 to 6 percent; Leafriver—0 to 1 percent

*Shape of areas:* Linear

*Size of areas:* 10 to 300 acres

### Typical Profile

#### Proper

*Surface layer:*

0 to 2 inches—black, partially decomposed leaf litter

*Subsurface layer:*

2 to 12 inches—dark grayish brown and grayish brown sand

*Subsoil:*

12 to 19 inches—dark brown, very friable sand with columns of strongly cemented sand

19 to 26 inches—brownish yellow, loose sand with columns of weakly cemented sand

26 to 40 inches—brownish yellow, mottled, loose sand with columns of weakly cemented sand

*Substratum:*

40 to 80 inches—pale brown and light yellowish brown, mottled sand

#### Leafriver

*Surface layer:*

0 to 10 inches—black muck

10 to 14 inches—black sand

14 to 35 inches—dark brownish gray, loose sand

*Substratum:*

35 to 60 inches—dark gray sand

60 to 80 inches—brown sand

### Soil Properties and Qualities

*Permeability:* Rapid

*Available water capacity:* Proper—low; Leafriver—moderate

*Drainage class:* Proper—moderately well drained; Leafriver—very poorly drained

*Seasonal high water table:* Proper—apparent, at a depth of 2.0 to 3.5 feet at some time from November through May; Leafriver—apparent, 1 foot above to 1 foot below the surface at some time from November through July

*Surface runoff:* Proper—very slow; Leafriver—very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Proper—severe; Leafriver—moderate

*Shrink-swell potential:* Low

*Potential for frost action:* Proper—low; Leafriver—high

### **Composition**

Proper soil and similar soils: 65 to 75 percent

Leafriver soil and similar soils: 25 to 35 percent

Contrasting inclusions: 5 to 25 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils
- The very poorly drained, sandy over clayey Wakeley soils

*Similar inclusions:*

- Very poorly drained soils that do not have muck at the surface
- Sandy soils that do not have a cemented subsoil
- Soils that have a thicker organic layer

### **Use and Management**

*Dominant land use:* Woodland

#### **Woodland**

*Major management concerns:* Proper—equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal droughtiness; Leafriver—equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Because loose sand can interfere with the traction of wheeled equipment in areas of the Proper soil, logging roads should be stabilized.
- Landing sites generally can be used only during the driest time of the year.
- Special harvest methods may be needed to control undesirable plants.
- Planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate in areas of the Proper soil. Replanting is needed in some areas.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced

and by such harvest methods as selective cutting and strip cutting.

- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Leafriver soil.

### **Building sites**

*Major management concerns:* Proper—cutbanks caving, seasonal wetness; Leafriver—ponding

*Management considerations:*

- Because cutbanks in areas of the Proper soil are not stable and are subject to caving, trench walls should be reinforced.
- In areas of the Proper soil, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- In areas of the Proper soil, wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Because of ponding, the Leafriver soil is generally unsuited to building site development.

### **Septic tank absorption fields**

*Major management concerns:* Proper—seasonal wetness, rapid permeability; Leafriver—ponding

*Management considerations:*

- The poor filtering capacity of the Proper soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- In areas of the Proper soil, filling or mounding with suitable fill material helps to raise the absorption field above the water table.
- Because of ponding, the Leafriver soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* V1w

*Woodland ordination symbol:* Proper—5W; Leafriver—2W

*Michigan soil management group:* Proper—5a-h; Leafriver—5c

## **375—Kanotin muck**

### **Setting**

*Landform:* Lake plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Oval or irregular

*Size of areas:* 3 to 150 acres

### Typical Profile

*Surface layer:*

0 to 9 inches—black muck

*Subsurface layer:*

9 to 12 inches—grayish brown sand

*Subsoil:*

12 to 26 inches—black, loose sand

26 to 46 inches—strong brown, loose sand

*Substratum:*

46 to 51 inches—brownish yellow sand

51 to 58 inches—dark brown, mottled, stratified very fine sand and silt loam

58 to 80 inches—gray silty clay

### Soil Properties and Qualities

*Permeability:* Rapid in the sandy part and very slow in the loamy and clayey parts

*Available water capacity:* Low

*Drainage class:* Very poorly drained

*Seasonal high water table:* Perched 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

### Composition

Kanotin soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### Inclusions

*Contrasting inclusions:*

- The somewhat poorly drained Mclvor soils
- The very poorly drained Wabun soils, which do not have a black and brown subsoil

*Similar inclusions:*

- Soils that have a thinner organic surface layer
- Soils that do not have clay in the substratum
- Soils that have a thicker organic surface layer

### Use and Management

*Dominant land use:* Woodland

#### Woodland

*Major management concerns:* Equipment limitations, plant competition, seedling mortality, windthrow hazard, seasonal wetness

*Management considerations:*

- This soil is generally unsuited to woodland because

of extreme acidity, the low strength of the organic material, and the wetness. Overcoming these limitations is not practical.

- Tree cover is sparse, but some spruce, tamarack, and jack pine grow around the edges of the unit. Shrubs are the most common vegetation.

#### Building sites

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

#### Septic tank absorption fields

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

### Interpretive Groups

*Land capability classification:* Vw

*Woodland ordination symbol:* 3W

*Michigan soil management group:* 5c-a

## 377—Wabun mucky sand

### Setting

*Landform:* Lake plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 5 to 50 acres

### Typical Profile

*Surface layer:*

0 to 6 inches—black mucky sand

*Substratum:*

6 to 10 inches—gray sand

10 to 30 inches—light brownish gray, mottled sand

30 to 48 inches—dark grayish brown, mottled sand

48 to 58 inches—grayish brown, stratified sand and fine sand

58 to 80 inches—gray silty clay

### Soil Properties and Qualities

*Permeability:* Rapid in the sandy part and very slow in the clayey part

*Available water capacity:* Low

*Drainage class:* Very poorly drained

*Seasonal high water table:* Perched 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight  
*Hazard of soil blowing:* Moderate  
*Shrink-swell potential:* Low  
*Potential for frost action:* Moderate

### **Composition**

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

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Tawas soils that have more than 16 inches of muck at the surface
- The somewhat poorly drained Mclvor soils

*Similar inclusions:*

- Soils that do not have a stratified substratum
- Soils that have a clayey substratum below a depth of 60 inches

### **Use and Management**

*Dominant land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seedling mortality, windthrow hazard, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Special harvest methods may be needed to control undesirable plants.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

#### **Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

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

### **378A—Algonquin clay, 0 to 3 percent slopes**

### **Setting**

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

### **Typical Profile**

*Surface layer:*  
 0 to 9 inches—very dark grayish brown clay

*Subsoil:*  
 9 to 13 inches—brown, mottled, firm clay  
 13 to 17 inches—reddish brown, mottled, firm silty clay

*Substratum:*  
 17 to 80 inches—reddish brown, mottled silty clay

### **Soil Properties and Qualities**

*Permeability:* Very slow  
*Available water capacity:* Moderate  
*Drainage class:* Somewhat poorly drained  
*Seasonal high water table:* Perched at a depth of 0.5 foot to 1.5 feet at some time from October through May  
*Surface runoff:* Slow  
*Flooding:* None  
*Hazard of water erosion:* Slight  
*Hazard of soil blowing:* Moderate  
*Shrink-swell potential:* High  
*Potential for frost action:* High

### **Composition**

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

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained, sandy over clayey Allendale soils
- The poorly drained Springport soils

*Similar inclusions:*

- Soils that have less clay in the subsoil
- Soils that have a surface layer of loam
- Soils that have sandy textures below a depth of 40 inches

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Woodland, pasture

#### **Cropland**

*Major management concerns:* Restricted permeability, seasonal wetness, soil compaction, tilth of the surface layer

*Management considerations:*

- Both surface and subsurface drainage systems are needed to reduce the wetness.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Crop residue management, green manure crops, applications of manure, cover crops, and conservation tillage help to maintain or improve tilth and increase the available water capacity and the organic matter content.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

#### **Pasture**

*Major management concerns:* Compaction, seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be planted.

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition

*Management considerations:*

- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of the restricted permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.
- Trees that can withstand seasonal wetness should be selected for planting.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

#### **Building sites**

*Major management concerns:* Seasonal wetness, shrink-swell

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

#### **Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, restricted permeability

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- A subsurface drainage system helps to lower the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IIIw

*Woodland ordination symbol:* 6W

*Michigan soil management group:* 1b

## **379A—Algonquin-Springport complex, 0 to 3 percent slopes**

### **Setting**

*Landform:* Lake plains

*Slope range:* Algonquin—0 to 3 percent; Springport—0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 50 to 300 acres

### **Typical Profile**

#### **Algonquin**

*Surface layer:*

0 to 9 inches—very dark grayish brown clay

*Subsoil:*

9 to 13 inches—brown, mottled, firm clay

13 to 17 inches—reddish brown, mottled, firm silty clay

*Substratum:*

17 to 80 inches—reddish brown, mottled silty clay

#### **Springport**

*Surface layer:*

0 to 11 inches—very dark gray silt loam

*Subsoil:*

11 to 27 inches—grayish brown, mottled, firm silty clay

*Substratum:*

27 to 80 inches—pinkish gray, mottled silty clay

### **Soil Properties and Qualities**

*Permeability:* Very slow

*Available water capacity:* Algonquin—moderate;  
Springport—high

*Drainage class:* Algonquin—somewhat poorly drained;  
Springport—poorly drained

*Seasonal high water table:* Algonquin—perched at a depth of 0.5 foot to 1.5 feet at some time from October through May; Springport—perched 1 foot above to 1 foot below the surface at some time from October through June

*Surface runoff:* Algonquin—slow; Springport—very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Algonquin—moderate;  
Springport—slight

*Shrink-swell potential:* High

*Potential for frost action:* High

### **Composition**

Algonquin soil and similar soils: 60 to 70 percent

Springport soil and similar soils: 30 to 40 percent

Contrasting inclusions: 5 to 10 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained, sandy over clayey Allendale soils
- The very poorly drained, sandy over clayey Wakeley soils

*Similar inclusions:*

- Poorly drained soils that have a mucky surface layer
- Soils that have a sandy surface layer
- Soils that are moderately well drained

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Cropland, pasture

#### **Cropland**

*Major management concerns:* Seasonal wetness, restricted permeability, soil compaction, tilling of the surface layer in areas of both soils; ponding an additional concern in areas of the Springport soil

*Management considerations:*

- Shallow surface ditches help to remove surface water after heavy rains.

- Both surface and subsurface drainage systems are needed to reduce the wetness.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.

#### **Pasture**

*Major management concerns:* Seasonal wetness, compaction

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Because of the restricted permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.
- Skidders should not be used during wet periods, when ruts form easily.
- Trees that can withstand seasonal wetness should be selected for planting on the Algonquin soil.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Springport soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Special harvest methods may be needed to control undesirable plants.

#### **Building sites**

*Major management concerns:* Algonquin—shrink-swell, seasonal wetness; Springport—ponding

*Management considerations:*

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- In areas of the Algonquin soil, buildings can be constructed on well compacted fill material, which

raises the site a sufficient distance above the water table.

- Because of ponding, the Springport soil is generally unsuited to building site development.

### Septic tank absorption fields

*Major management concerns:* Algonquin—seasonal wetness, restricted permeability; Springport—ponding

*Management considerations:*

- In areas of the Algonquin soil, filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability of the Algonquin soil.
- Because of ponding, the Springport soil is generally unsuited to septic tank absorption fields.

### Interpretive Groups

*Land capability classification:* Vw

*Woodland ordination symbol:* 6W

*Michigan soil management group:* Algonquin—1b; Springport—1c

## 380—Access denied

*Shape of areas:* Square or rectangular

*Size of areas:* 20 to 160 acres

### Use and Management

*Management considerations:*

- Because access to these areas was denied, information concerning use and management is not available. Onsite investigation is needed.

### Interpretive Groups

*Land capability classification:* None assigned

*Woodland ordination symbol:* None assigned

*Michigan soil management group:* None assigned

## 381A—Mclvor-Wakeley complex, 0 to 3 percent slopes

### Setting

*Landform:* Lake plains

*Slope range:* Mclvor—0 to 3 percent; Wakeley—0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 200 acres

## Typical Profile

### Mclvor

*Surface layer:*

0 to 2 inches—undecomposed leaf litter

*Subsurface layer:*

2 to 4 inches—dark gray sand

4 to 10 inches—pinkish gray sand

10 to 20 inches—pinkish gray and white, mottled sand

*Subsoil:*

20 to 26 inches—dark reddish brown and yellowish brown, mottled, firm, weakly to strongly cemented sand

26 to 31 inches—dark yellowish brown, mottled, loose sand

*Substratum:*

31 to 58 inches—pale brown sand

58 to 80 inches—reddish brown silty clay

### Wakeley

*Surface layer:*

0 to 5 inches—black muck

*Substratum:*

5 to 16 inches—dark grayish brown and grayish brown, mottled sand

16 to 27 inches—brown, mottled sand

27 to 80 inches—reddish brown and pinkish gray, mottled clay

## Soil Properties and Qualities

*Permeability:* Mclvor—moderately rapid in the sandy part and very slow in the clayey part; Wakeley—rapid in the sandy part and very slow in the clayey part

*Available water capacity:* Mclvor—low; Wakeley—moderate

*Drainage class:* Mclvor—somewhat poorly drained; Wakeley—very poorly drained

*Seasonal high water table:* Mclvor—perched at a depth of 0.5 foot to 1.5 feet at some time from October through May; Wakeley—perched 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Mclvor—very slow; Wakeley—very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Mclvor—severe; Wakeley—moderate

*Shrink-swell potential:* Mclvor—low; Wakeley—high  
*Potential for frost action:* Moderate

### **Composition**

Mclvor soil and similar soils: 40 to 50 percent  
 Wakeley soil and similar soils: 30 to 40 percent  
 Contrasting inclusions: 10 to 25 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained, sandy Deford soils
- The somewhat poorly drained, sandy Au Gres soils

*Similar inclusions:*

- Poorly drained soils that have a clayey substratum at a depth of more than 40 inches
- Soils that do not have clay in the substratum
- Areas of Mclvor soils in which less than 90 percent of the subsoil is cemented

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Pasture

#### **Pasture**

*Major management concerns:* Mclvor—seasonal wetness, seasonal droughtiness; Wakeley—seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

#### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seedling mortality, windthrow hazard, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, and midwinter, when the soil is frozen or has an adequate snow cover.
- In areas of the Mclvor soil, loose sand can interfere with the traction of wheeled equipment. Logging roads should be stabilized.
- Trees that can withstand seasonal wetness should be selected for planting on the Mclvor soil.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Wakeley soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced

and by such harvest methods as selective cutting and strip cutting.

- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

#### **Building sites**

*Major management concerns:* Mclvor—cutbanks caving, seasonal wetness; Wakeley—ponding

*Management considerations:*

- Because cutbanks in areas of the Mclvor soil are not stable and are subject to caving, trench walls should be reinforced.
- In areas of the Mclvor soil, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- In areas of the Mclvor soil, wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Because of ponding, the Wakeley soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Mclvor—seasonal wetness, rapid permeability; Wakeley—ponding

*Management considerations:*

- The poor filtering capacity of the Mclvor soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- In areas of the Mclvor soil, filling or mounding with suitable fill material helps to raise the absorption field above the water table.
- Because of ponding, the Wakeley soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* IVw

*Woodland ordination symbol:* Mclvor—2W; Wakeley—3W

*Michigan soil management group:* Mclvor—5b-h; Wakeley—4/1c

## **382B—Proper sand, 0 to 6 percent slopes**

### **Setting**

*Landform:* Beach ridges and dunes

*Shape of areas:* Irregular

*Size of areas:* 3 to 50 acres

### Typical Profile

*Surface layer:*

0 to 2 inches—black, partially decomposed leaf litter

*Subsurface layer:*

2 to 12 inches—dark grayish brown and grayish brown sand

*Subsoil:*

12 to 19 inches—dark brown, very friable sand with columns of strongly cemented sand

19 to 26 inches—brownish yellow, loose sand with columns of weakly cemented sand

26 to 40 inches—brownish yellow, mottled, loose sand with columns of weakly cemented sand

*Substratum:*

40 to 80 inches—pale brown and light yellowish brown, mottled sand

### Soil Properties and Qualities

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Moderately well drained

*Seasonal high water table:* Apparent, at a depth of 2.0 to 3.5 feet at some time from November through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

### Composition

Proper soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### Inclusions

*Contrasting inclusions:*

- The somewhat poorly drained Finch soils

*Similar inclusions:*

- Soils in which less than 50 percent of the subsoil is cemented
- Soils that have a clayey substratum
- Well drained soils in areas where the slopes are more than 6 percent

### Use and Management

*Dominant land use:* Woodland

#### Woodland

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness, plant competition

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate. Replanting is needed in some areas.
- Planting when the soil is moist can reduce the seedling mortality rate.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

### Building sites

*Major management concerns:* Cutbanks caving, seasonal wetness

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

### Septic tank absorption fields

*Major management concerns:* Seasonal wetness, rapid permeability

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- A subsurface drainage system helps to lower the water table.

### Interpretive Groups

*Land capability classification:* IVs

*Woodland ordination symbol:* 5W

*Michigan soil management group:* 5a-h

### 383B—Wurtsmith sand, 0 to 6 percent slopes

#### Setting

*Landform:* Outwash plains, river terraces, and lake plains

*Shape of areas:* Irregular

*Size of areas:* 10 to 100 acres

### **Typical Profile**

*Surface layer:*

0 to 1 inch—black, partially decomposed leaf litter

*Subsurface layer:*

1 to 4 inches—grayish brown sand

*Subsoil:*

4 to 14 inches—yellowish brown, very friable sand

14 to 24 inches—brownish yellow, very friable sand

*Substratum:*

24 to 80 inches—pale brown and brown, mottled sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Moderately well drained

*Seasonal high water table:* Apparent, at a depth of 2.0 to 3.5 feet at some time from November through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

### **Composition**

Wurtsmith soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils
- The excessively drained Grayling soils
- The somewhat excessively drained Graycalm soils

*Similar inclusions:*

- Soils that have a darker substratum

### **Use and Management**

*Dominant land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, seasonal droughtiness, windthrow hazard

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty

conditions can reduce the seedling mortality rate.

Replanting is needed in some areas.

- Planting when the soil is moist can reduce the seedling mortality rate.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

#### **Building sites**

*Major management concerns:* Cutbanks caving, seasonal wetness

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

#### **Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, rapid permeability

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

### **Interpretive Groups**

*Land capability classification:* IVs

*Woodland ordination symbol:* 6S

*Michigan soil management group:* 5a

## **392—Caffey mucky sand**

### **Setting**

*Landform:* Lake plains and till plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 5 to 50 acres

### **Typical Profile**

*Surface layer:*

0 to 8 inches—black mucky sand

*Subsoil:*

8 to 37 inches—brown and yellowish brown, mottled, very friable sand

*Substratum:*

37 to 80 inches—grayish brown, mottled loam

### **Soil Properties and Qualities**

*Permeability:* Moderately rapid in the sandy part and moderately slow in the loamy part

*Available water capacity:* Low

*Drainage class:* Poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

### **Composition**

Caffey soil and similar soils: 85 to 90 percent

Contrasting inclusions: 10 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Deford soils
- The somewhat poorly drained Kokosing soils

*Similar inclusions:*

- Soils that contain more clay in the substratum
- Soils that have a surface layer of sand

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Pasture

#### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seasonal wetness, seedling mortality, windthrow hazard

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Selective cutting or cutting in strips and leaving desirable seed trees along the edge of the openings are beneficial for natural regeneration.
- Carefully managed reforestation helps to control undesirable understory plants.
- Because of wetness, seedling mortality, and plant

competition, trees are generally not planted on this soil.

- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

#### **Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* 2W

*Michigan soil management group:* 4/2c

## **403B—largo silt loam, 2 to 6 percent slopes**

### **Setting**

*Landform:* Lake plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 100 acres

### **Typical Profile**

*Surface layer:*

0 to 8 inches—very dark grayish brown silt loam

*Subsoil:*

8 to 12 inches—brown, firm silty clay

12 to 19 inches—strong brown, mottled, firm silty clay

*Substratum:*

19 to 45 inches—brown, mottled silty clay loam with strata of silt loam

45 to 80 inches—light olive brown and brown, mottled silt loam with strata of very fine sand and silty clay loam

### **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* Moderate

*Drainage class:* Moderately well drained

*Seasonal high water table:* Perched at a depth of 2.5 to 3.5 feet at some time from November through May

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* High

*Potential for frost action:* High

### **Composition**

largo soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Allendale soils
- The poorly drained Springport soils

*Similar inclusions:*

- Soils in which the mottles are higher in the profile
- Soils that have less stratification in the substratum
- Soils that have sandy stratification below a depth of 60 inches

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

#### **Cropland**

*Major management concerns:* Seasonal wetness, soil compaction, tilth in the surface layer, water erosion, nutrient and pesticide loss

*Management considerations:*

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
- Conservation tillage systems, contour farming, cover crops, and sod-based rotations can minimize the detachment and loss of nutrients associated with sediment and thus help to prevent the loss of solid-phase nitrogen and phosphorus.
- Shallow surface ditches help to remove surface water after heavy rains.
- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

#### **Pasture**

*Major management concerns:* Compaction, seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.

- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

#### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seasonal wetness, windthrow hazard

*Management considerations:*

- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
- Equipment should be used only when the soil is relatively dry or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Landing sites generally can be used only during the driest time of the year.
- Trees that can withstand seasonal wetness should be selected for planting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

#### **Building sites**

*Major management concerns:* Seasonal wetness, shrink-swell

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

#### **Septic tank absorption fields**

*Major management concerns:* Restricted permeability, seasonal wetness

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- A subsurface drainage system helps to lower the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IIIe

*Woodland ordination symbol:* 3L

*Michigan soil management group:* 1.5a

## **403C—largo silt loam, 6 to 12 percent slopes**

### **Setting**

*Landform:* Lake plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 25 acres

### **Typical Profile**

*Surface layer:*

0 to 8 inches—very dark grayish brown silt loam

*Subsoil:*

8 to 12 inches—brown, firm silty clay

12 to 19 inches—strong brown, mottled, firm silty clay

*Substratum:*

19 to 45 inches—brown, mottled silty clay loam with strata of silt loam

45 to 80 inches—light olive brown and brown, mottled silt loam with strata of very fine sand and silty clay loam

### **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* Moderate

*Drainage class:* Moderately well drained

*Seasonal high water table:* Perched at a depth of 2.5 to 3.5 feet at some time from November through May

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* High

*Potential for frost action:* High

### **Composition**

largo soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Allendale soils
- The poorly drained Springport soils

*Similar inclusions:*

- Soils in which the mottles are higher in the profile

- Soils that have less stratification in the substratum
- Soils that have sandy stratification below a depth of 60 inches

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

#### **Cropland**

*Major management concerns:* Seasonal wetness, soil compaction, tillage in the surface layer, water erosion, nutrient and pesticide loss

*Management considerations:*

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
- Shaping and maintaining grassed waterways promote the safe removal of runoff from the fields.
- Conservation tillage systems, contour farming, cover crops, and sod-based rotations can minimize the detachment and loss of nutrients associated with sediment and thus help to prevent the loss of solid-phase nitrogen and phosphorus.
- Shallow surface ditches help to remove surface water after heavy rains.
- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tillage.

#### **Pasture**

*Major management concerns:* Compaction, seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.
- Restricted grazing during wet periods helps to prevent compaction and poor tillage.

#### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seasonal wetness, windthrow hazard

*Management considerations:*

- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
- Equipment should be used only when the soil is relatively dry or has an adequate snow cover.

- Skidders should not be used during wet periods, when ruts form easily.
- Landing sites generally can be used only during the driest time of the year.
- Trees that can withstand seasonal wetness should be selected for planting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

### **Building sites**

*Major management concerns:* Seasonal wetness, shrink-swell, slope

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

### **Septic tank absorption fields**

*Major management concerns:* Restricted permeability, seasonal wetness, slope

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- A subsurface drainage system helps to lower the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

### **Interpretive Groups**

*Land capability classification:* IIIe

*Woodland ordination symbol:* 3L

*Michigan soil management group:* 1.5a

## **404A—Manary silty clay loam, 0 to 3 percent slopes**

### **Setting**

*Landform:* Lake plains

*Shape of areas:* Irregular

*Size of areas:* 3 to 200 acres

### **Typical Profile**

*Surface layer:*

0 to 11 inches—black silty clay loam

*Subsoil:*

11 to 18 inches—brown, mottled, firm silty clay loam

*Substratum:*

18 to 29 inches—reddish brown, mottled silty clay

29 to 80 inches—brown and reddish brown silty clay loam with strata of brown and pale brown loamy fine sand

### **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* Moderate

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Perched at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* High

*Potential for frost action:* High

### **Composition**

Manary soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained, sandy over clayey Allendale soils
- The poorly drained Springport soils

*Similar inclusions:*

- Soils that have a surface layer of loam

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

### **Cropland**

*Major management concerns:* Restricted permeability,

seasonal wetness, soil compaction, tilth in the surface layer

*Management considerations:*

- Most adapted crops can be grown if an adequate drainage system is installed.
- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Shallow surface ditches help to remove surface water after heavy rains.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.

**Pasture**

*Major management concerns:* Compaction, seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

**Woodland**

*Major management concerns:* Equipment limitations, plant competition, windthrow hazard, seasonal wetness

*Management considerations:*

- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.

**Building sites**

*Major management concerns:* Seasonal wetness, shrink-swell

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, restricted permeability

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- A subsurface drainage system helps to lower the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

***Interpretive Groups***

*Land capability classification:* 11w

*Woodland ordination symbol:* 4C

*Michigan soil management group:* 1.5b

**405B—Manary-largo complex, 0 to 6 percent slopes**

***Setting***

*Landform:* Lake plains

*Slope range:* Manary—0 to 3 percent; largo—2 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 20 to 200 acres

***Typical Profile***

**Manary**

*Surface layer:*

0 to 11 inches—black silty clay loam

*Subsoil:*

11 to 18 inches—brown, mottled, firm silty clay loam

**Substratum:**

18 to 29 inches—reddish brown, mottled silty clay  
 29 to 80 inches—brown and reddish brown silty clay  
 loam with strata of brown and pale brown loamy  
 fine sand

**largo****Surface layer:**

0 to 8 inches—very dark grayish brown silt loam

**Subsoil:**

8 to 12 inches—brown, firm silty clay  
 12 to 19 inches—strong brown, mottled, firm silty clay

**Substratum:**

19 to 45 inches—brown, mottled silty clay loam with  
 strata of silt loam  
 45 to 80 inches—light olive brown and brown, mottled  
 silt loam with strata of very fine sand and silty clay  
 loam

**Soil Properties and Qualities**

**Permeability:** Slow

**Available water capacity:** Moderate

**Drainage class:** Manary—somewhat poorly drained;  
 largo—moderately well drained

**Seasonal high water table:** Manary—perched at a  
 depth of 0.5 foot to 1.5 feet at some time from  
 October through May; largo—perched at a depth  
 of 2.5 to 3.5 feet at some time from November  
 through May

**Surface runoff:** Manary—slow; largo—medium

**Flooding:** None

**Hazard of water erosion:** Manary—slight; largo—  
 moderate

**Hazard of soil blowing:** Manary—moderate; largo—  
 slight

**Shrink-swell potential:** High

**Potential for frost action:** High

**Composition**

Manary soil and similar soils: 50 to 60 percent

largo soil and similar soils: 40 to 50 percent

Contrasting inclusions: 5 to 10 percent

**Inclusions****Contrasting inclusions:**

- The poorly drained Springport soils
- The somewhat poorly drained, sandy over clayey Allendale soils

**Similar inclusions:**

- Soils that have a surface layer of loam
- Soils that have less stratification in the substratum

**Use and Management**

**Dominant land use:** Cropland

**Other uses:** Pasture, woodland

**Cropland**

**Major management concerns:** Manary—seasonal  
 wetness, soil compaction, tilth in the surface layer,  
 restricted permeability; largo—seasonal wetness,  
 soil compaction, tilth in the surface layer, restricted  
 permeability, water erosion, nutrient and pesticide  
 loss

**Management considerations:**

- Shallow surface ditches help to remove surface water after heavy rains.
- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss in areas of the largo soil.
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing in areas of the largo soil.
- In areas of the largo soil, conservation tillage systems, contour farming, cover crops, and sod-based rotations can minimize the detachment and loss of nutrients associated with sediment and thus help to prevent the loss of solid-phase nitrogen and phosphorus.

**Pasture**

**Major management concerns:** Compaction, seasonal wetness

**Management considerations:**

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

## Woodland

*Major management concerns:* Equipment limitations, plant competition, seasonal wetness, windthrow

*Management considerations:*

- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
- Equipment should be used only when the soil is relatively dry or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Landing sites generally can be used only during the driest time of the year.
- Trees that can withstand seasonal wetness should be selected for planting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

### Building sites

*Major management concerns:* Seasonal wetness, shrink-swell

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

### Septic tank absorption fields

*Major management concerns:* Restricted permeability, seasonal wetness

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- A subsurface drainage system helps to lower the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### Interpretive Groups

*Land capability classification:* Ilw

*Woodland ordination symbol:* Manary—4C; Iargo—3L

*Michigan soil-management group:* Manary—1.5b; Iargo—1.5a

## 406A—Winterfield loamy sand, rarely flooded, 0 to 2 percent slopes

### Setting

*Landform:* Flood plains

*Shape of areas:* Linear

*Size of areas:* 10 to 100 acres

### Typical Profile

*Surface layer:*

0 to 8 inches—very dark brown loamy sand

*Substratum:*

8 to 18 inches—brown, mottled loamy sand

18 to 45 inches—brown, mottled sand

45 to 80 inches—grayish brown, mottled sand with strata of fine sand

### Soil Properties and Qualities

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* Rare

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

### Composition

Winterfield soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### Inclusions

*Contrasting inclusions:*

- The very poorly drained Tawas soils

*Similar inclusions:*

- Soils that have a darker substratum
- Soils that have a surface layer of sand

### Use and Management

*Dominant land use:* Woodland

*Other uses:* Pasture

### Pasture

*Major management concerns:* Seasonal droughtiness, seasonal wetness

*Management considerations:*

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.

### Woodland

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal droughtiness, seasonal wetness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting seedlings that can withstand droughty conditions can also reduce the seedling mortality rate. Replanting is needed in some areas.
- Trees that can withstand seasonal wetness should be selected for planting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

### Building sites

*Major management concerns:* Cutbanks caving, seasonal wetness

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

### Septic tank absorption fields

*Major management concerns:* Rapid permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

- A subsurface drainage system helps to lower the water table.

### Interpretive Groups

*Land capability classification:* IVw

*Woodland ordination symbol:* 6W

*Michigan soil management group:* L-4c

### 407—Lacota loam

#### Setting

*Landform:* Lake plains and outwash plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 250 acres

#### Typical Profile

*Surface layer:*

0 to 10 inches—black loam

*Subsoil:*

10 to 16 inches—grayish brown, mottled, friable loam

16 to 28 inches—grayish brown, mottled, friable clay loam

*Substratum:*

28 to 60 inches—brown, mottled sand

60 to 80 inches—grayish brown sand

#### Soil Properties and Qualities

*Permeability:* Moderately slow in the loamy part and rapid in the sandy part

*Available water capacity:* Low

*Drainage class:* Poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* Moderate

*Potential for frost action:* High

#### Composition

Lacota soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

#### Inclusions

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils

*Similar inclusions:*

- Soils that contain more gravel in the substratum
- Soils in which the water table is at a lower depth

## **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

### **Cropland**

*Major management concerns:* Seasonal wetness, low available water capacity

*Management considerations:*

- Most adapted crops can be grown if an adequate drainage system is installed.
- Subsurface drains can reduce the wetness if a suitable outlet is available.
- The rate of water infiltration can be increased by growing cover crops, leaving crop residue on the surface, and regularly adding other organic material.

### **Pasture**

*Major management concerns:* Seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.

### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seasonal wetness, seedling mortality, windthrow hazard

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

### **Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

### **Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

## **Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* 2W

*Michigan soil management group:* 3c

## **408—Sims loam**

### **Setting**

*Landform:* Till plains and moraines

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 5 to 100 acres

### **Typical Profile**

*Surface layer:*

0 to 5 inches—black loam

*Subsoil:*

5 to 47 inches—dark gray and gray, mottled, firm clay loam

*Substratum:*

47 to 80 inches—light reddish brown, mottled clay loam

### **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* High

*Drainage class:* Poorly drained

*Seasonal high water table:* Perched 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* Moderate

*Potential for frost action:* High

### **Composition**

Sims soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The poorly drained, sandy over loamy Caffey soils

*Similar inclusions:*

- Soils that have a surface layer of sandy loam
- Soils that have a surface layer of clay loam

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Pasture

#### **Pasture**

*Major management concerns:* Compaction, seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

#### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seasonal wetness, seedling mortality, windthrow hazard

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Skidders should not be used during wet periods, when ruts form easily.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants.

#### **Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* 4W

*Michigan soil management group:* 1.5c

### **409A—Finch-Deford-Au Gres complex, 0 to 3 percent slopes**

#### **Setting**

*Landform:* Lake plains

*Slope range:* Finch and Au Gres—0 to 3 percent; Deford—0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 50 to 500 acres

#### **Typical Profile**

##### **Finch**

*Surface layer:*

0 to 3 inches—black, well decomposed leaf litter

*Subsurface layer:*

3 to 6 inches—gray, mottled sand

6 to 12 inches—light brownish gray, mottled sand

*Subsoil:*

12 to 13 inches—dark reddish brown, strongly cemented, very firm sand

13 to 21 inches—dark reddish brown and black, strongly cemented, very firm sand

21 to 28 inches—yellowish brown, loose, mottled sand

*Substratum:*

28 to 36 inches—yellowish brown, mottled sand

36 to 80 inches—brown sand

##### **Deford**

*Surface layer:*

0 to 5 inches—black muck

*Substratum:*

5 to 21 inches—light brownish gray, mottled sand

21 to 42 inches—pale brown and grayish brown fine sand

42 to 80 inches—grayish brown sand

##### **Au Gres**

*Surface layer:*

0 to 3 inches—black, partially decomposed leaf litter

*Subsurface layer:*

3 to 9 inches—pinkish gray, mottled sand

*Subsoil:*

9 to 11 inches—dark reddish brown, mottled, very friable sand

11 to 14 inches—dark brown, mottled, very friable sand

14 to 29 inches—yellowish brown, mottled, loose sand

*Substratum:*

29 to 80 inches—very pale brown sand

### **Soil Properties and Qualities**

*Permeability:* Finch—moderately rapid; Deford—rapid; Au Gres—rapid

*Available water capacity:* Low

*Drainage class:* Finch—somewhat poorly drained; Deford—very poorly drained; Au Gres—somewhat poorly drained

*Seasonal high water table:* Finch and Au Gres—apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May; Deford—apparent, 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Finch—very slow; Deford—very slow or ponded; Au Gres—very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Finch—severe; Deford—moderate; Au Gres—severe

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

### **Composition**

Finch soil and similar soils: 25 to 35 percent

Deford soil and similar soils: 25 to 35 percent

Au Gres soil and similar soils: 25 to 35 percent

Contrasting inclusions: 0 to 25 percent

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained Proper soils
- The very poorly drained Tawas soils that have more than 16 inches of muck at the surface

*Similar inclusions:*

- Poorly drained soils that have a surface layer of sand
- Soils that have a lighter colored subsoil
- Soils that contain clay below a depth of 40 inches

### **Use and Management**

*Dominant land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition, seedling mortality, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Carefully managed reforestation helps to control undesirable understory plants.

- Special harvest methods may be needed to control undesirable plants.
- Trees that can withstand seasonal wetness should be selected for planting on the Finch and Au Gres soils.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Deford soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

### **Building sites**

*Major management concerns:* Finch and Au Gres—cutbanks caving, seasonal wetness; Deford—ponding

*Management considerations:*

- Because cutbanks in areas of the Finch and Au Gres soils are not stable and are subject to caving, trench walls should be reinforced.
- In areas of the Finch and Au Gres soils, wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- In areas of the Finch and Au Gres soils, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Because of ponding, the Deford soil is generally unsuited to building site development.

### **Septic tank absorption fields**

*Major management concerns:* Finch—seasonal wetness; Deford—ponding; Au Gres—rapid permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of the Au Gres soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable fill material helps to raise the absorption field above the water table in areas of the Finch and Au Gres soils.
- Because of ponding, the Deford soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* IVw

*Woodland ordination symbol:* Finch—4W; Deford—4W; Au Gres—6W

*Michigan soil management group:* Finch—5b-h; Deford—4c; Au Gres—5b

## 410B—Proper-Finch-Deford complex, 0 to 6 percent slopes

### Setting

*Landform:* Lake plains and dunes

*Slope range:* Proper—0 to 6 percent; Finch—0 to 3 percent; Deford—0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 50 to 500 acres

### Typical Profile

#### Proper

*Surface layer:*

0 to 2 inches—black, partially decomposed leaf litter

*Subsurface layer:*

2 to 5 inches—dark grayish brown sand

5 to 12 inches—grayish brown sand

*Subsoil:*

12 to 19 inches—dark brown, very friable sand with columns of strongly cemented sand

19 to 26 inches—brownish yellow, loose sand with columns of weakly cemented sand

26 to 40 inches—brownish yellow, mottled, loose sand with columns of weakly cemented sand

*Substratum:*

40 to 55 inches—pale brown, mottled sand

55 to 80 inches—light yellowish brown, mottled sand

#### Finch

*Surface layer:*

0 to 3 inches—black, well decomposed leaf litter

*Subsurface layer:*

3 to 6 inches—gray, mottled sand

6 to 12 inches—light brownish gray, mottled sand

*Subsoil:*

12 to 13 inches—dark reddish brown, strongly cemented, very firm sand

13 to 21 inches—dark reddish brown and black, strongly cemented, very firm sand

21 to 28 inches—yellowish brown, loose, mottled sand

*Substratum:*

28 to 36 inches—yellowish brown, mottled sand

36 to 80 inches—brown sand

#### Deford

*Surface layer:*

0 to 5 inches—black muck

*Substratum:*

5 to 21 inches—light brownish gray, mottled sand

21 to 42 inches—pale brown and grayish brown fine sand

42 to 80 inches—grayish brown sand

### Soil Properties and Qualities

*Permeability:* Proper—rapid; Finch—moderately rapid; Deford—rapid

*Available water capacity:* Low

*Drainage class:* Proper—moderately well drained; Finch—somewhat poorly drained; Deford—very poorly drained

*Seasonal high water table:* Proper—apparent, at a depth of 2.0 to 3.5 feet at some time from November through May; Finch—apparent, at a depth of 0.5 foot to 1.5 feet at some time from October through May; Deford—apparent, 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Proper—very slow; Finch—very slow; Deford—very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Proper—severe; Finch—severe; Deford—moderate

*Shrink-swell potential:* Low

*Potential for frost action:* Proper—low; Finch—moderate; Deford—moderate

### Composition

Proper soil and similar soils: 25 to 35 percent

Finch soil and similar soils: 25 to 35 percent

Deford soil and similar soils: 25 to 35 percent

Contrasting inclusions: 0 to 25 percent

### Inclusions

*Contrasting inclusions:*

- The excessively drained Deer Park soils
- The very poorly drained Tawas soils, which have more than 16 inches of muck at the surface

*Similar inclusions:*

- Poorly drained soils that have a surface layer of sand
- Soils that have a lighter colored subsoil
- Soils that contain clay below a depth of 40 inches

### Use and Management

*Dominant land use:* Woodland

#### Woodland

*Major management concerns:* Proper—equipment limitations, plant competition, seedling mortality, seasonal droughtiness; Finch and Deford—

equipment limitations, plant competition, seedling mortality, seasonal wetness, windthrow hazard

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads in areas of the Proper and Finch soils should be stabilized.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Planting when the soil is moist can reduce the seedling mortality rate in areas of the Proper soil.
- Trees that can withstand seasonal wetness should be selected for planting on the Finch soil.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Deford soil.
- In areas of the Finch and Deford soils, windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

**Building sites**

*Major management concerns:* Proper and Finch—cutbanks caving, seasonal wetness; Deford—ponding

*Management considerations:*

- Because cutbanks in areas of the Proper and Finch soils are not stable and are subject to caving, trench walls should be reinforced.
- In areas of the Proper and Finch soils, wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- In areas of the Proper and Finch soils, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Because of ponding, the Deford soil is generally unsuited to building site development.

**Septic tank absorption fields**

*Major management concerns:* Proper and Finch—seasonal wetness, rapid permeability; Deford—ponding

*Management considerations:*

- The poor filtering capacity of the Proper and Finch soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the

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

- Filling or mounding with suitable fill material helps to raise the absorption field above the water table in areas of the Proper and Finch soils.
- Because of ponding, the Deford soil is generally unsuited to septic tank absorption fields.

**Interpretive Groups**

*Land capability classification:* Vs

*Woodland ordination symbol:* Proper—5W; Finch—4W; Deford—4W

*Michigan soil management group:* Proper—5a-h; Finch—5b-h; Deford—4c

**411A—Meehan sand, 0 to 3 percent slopes**

**Setting**

*Landform:* Stream terraces, outwash plains, and beach ridges

*Shape of areas:* Irregular

*Size of areas:* 3 to 100 acres

**Typical Profile**

*Organic mat:*

0 to 1 inch—undecomposed leaf litter

*Surface layer:*

1 to 3 inches—very dark gray sand

*Subsurface layer:*

3 to 10 inches—pale brown sand

*Subsoil:*

10 to 22 inches—brown and yellowish brown, mottled, very friable sand

22 to 44 inches—light yellowish brown, mottled, loose sand

*Substratum:*

44 to 80 inches—brown sand

**Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Apparent, at a depth of 1 to 3 feet at some time from October through June

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

### **Composition**

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

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Deford soils
- The excessively drained Grayling soils

*Similar inclusions:*

- Soils in which the water table is at a slightly lower depth

### **Use and Management**

*Dominant land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seasonal wetness, seedling mortality, windthrow hazard

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Trees that can withstand seasonal wetness should be selected for planting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

#### **Building sites**

*Major management concerns:* Seasonal wetness, cutbanks caving

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

### **Septic tank absorption fields**

*Major management concerns:* Rapid permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- A subsurface drainage system helps to lower the water table.

### **Interpretive Groups**

*Land capability classification:* IVw

*Woodland ordination symbol:* 5W

*Michigan soil management group:* 5b

## **425D—Hottis sandy loam, 12 to 18 percent slopes**

### **Setting**

*Landform:* Till plains and moraines

*Shape of areas:* Linear

*Size of areas:* 5 to 25 acres

### **Typical Profile**

*Surface layer:*

0 to 5 inches—very dark gray sandy loam

*Subsurface layer:*

5 to 9 inches—brown sandy loam and dark yellowish brown sandy loam

*Subsoil:*

9 to 13 inches—brown, firm clay and brown, firm sandy loam

13 to 33 inches—strong brown, firm clay

33 to 80 inches—brown, firm clay

### **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* Moderate

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* High  
*Potential for frost action:* High

### **Composition**

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

### **Inclusions**

*Contrasting inclusions:*

- The well drained, sandy over loamy Menominee soils

*Similar inclusions:*

- Soils that have a sandy substratum
- Soils that have less clay in the subsoil
- Soils that have a surface layer of clay loam

### **Use and Management**

*Dominant land use:* Woodland  
*Other uses:* Pasture

#### **Pasture**

*Major management concerns:* Compaction

*Management considerations:*

- Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

#### **Woodland**

*Major management concerns:* Plant competition, equipment limitations, windthrow hazard

*Management considerations:*

- Carefully managed reforestation helps to control undesirable understory plants.
- If trees are planted, site preparation is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Because of the restricted permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.
- The grade should be kept as low as possible.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

#### **Building sites**

*Major management concerns:* Shrink-swell, slope

*Management considerations:*

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Because of the slope, this soil is poorly suited to building site development unless extensive land shaping is feasible.

### **Septic tank absorption fields**

*Major management concerns:* Restricted permeability, slope

*Management considerations:*

- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

### **Interpretive Groups**

*Land capability classification:* IVe

*Woodland ordination symbol:* 3C

*Michigan soil management group:* 1a

## **426B—Coppler loamy sand, 0 to 6 percent slopes**

### **Setting**

*Landform:* Stream terraces and outwash channels

*Shape of areas:* Irregular or linear

*Size of areas:* 10 to 50 acres

### **Typical Profile**

*Surface layer:*

0 to 5 inches—very dark gray loamy sand

*Subsoil:*

5 to 17 inches—yellowish brown, very friable loamy sand

17 to 24 inches—yellowish brown, very friable gravelly sand

24 to 29 inches—dark brown, friable very gravelly sandy loam

*Substratum:*

29 to 80 inches—pale brown very gravelly sand

### **Soil Properties and Qualities**

*Permeability:* Moderately rapid in the upper part and very rapid in the lower part

*Available water capacity:* Low

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* Low

### **Composition**

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

### **Inclusions**

*Contrasting inclusions:*

- The excessively drained Grayling soils
- The somewhat poorly drained Gladwin soils

*Similar inclusions:*

- Soils that contain less gravel in the substratum

### **Use and Management**

*Dominant land use:* Woodland

#### **Woodland**

*Major management concerns:* None

#### **Building sites**

*Major management concerns:* Cutbanks caving

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

#### **Septic tank absorption fields**

*Major management concerns:* Rapid permeability

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

### **Interpretive Groups**

*Land capability classification:* IIIs

*Woodland ordination symbol:* 3A

*Michigan soil management group:* 4a

## **426C—Coppler loamy sand, 6 to 12 percent slopes**

### **Setting**

*Landform:* Stream terraces

*Shape of areas:* Irregular or linear

*Size of areas:* 5 to 25 acres

### **Typical Profile**

*Surface layer:*

0 to 5 inches—very dark gray loamy sand

*Subsoil:*

5 to 17 inches—yellowish brown, very friable loamy sand

17 to 24 inches—yellowish brown, very friable gravelly sand

24 to 29 inches—dark brown, friable very gravelly sandy loam

*Substratum:*

29 to 80 inches—pale brown very gravelly sand

### **Soil Properties and Qualities**

*Permeability:* Moderately rapid in the upper part and very rapid in the lower part

*Available water capacity:* Low

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Slow

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* Low

### **Composition**

Coppler soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Gladwin soils
- The excessively drained Grayling soils

*Similar inclusions:*

- Soils that contain less gravel in the substratum

### **Use and Management**

*Dominant land use:* Woodland

#### **Woodland**

*Major management concerns:* None

#### **Building sites**

*Major management concerns:* Cutbanks caving, slope

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

#### **Septic tank absorption fields**

*Major management concerns:* Slope, rapid permeability

*Management considerations:*

- Land shaping and installing the distribution lines on the contour help to overcome the slope.

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

### **Interpretive Groups**

*Land capability classification:* IIIe

*Woodland ordination symbol:* 3A

*Michigan soil management group:* 4a

## **427—Tonkey sandy loam**

### **Setting**

*Landform:* Till plains and outwash plains

*Slope range:* 0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 5 to 50 acres

### **Typical Profile**

*Surface layer:*

0 to 7 inches—black sandy loam

*Subsoil:*

7 to 9 inches—grayish brown, very friable loamy sand

9 to 12 inches—light brownish gray, mottled, very friable sandy loam

12 to 17 inches—light yellowish brown, mottled, firm sandy clay loam

*Substratum:*

17 to 80 inches—light yellowish brown, pale brown, light brownish gray, and gray, mottled, stratified fine sand, very fine sand, loam, and silt loam

### **Soil Properties and Qualities**

*Permeability:* Moderately rapid

*Available water capacity:* Moderate

*Drainage class:* Poorly drained

*Seasonal high water table:* Apparent, 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* High

### **Composition**

Tonkey soil and similar soils: 85 to 90 percent

Contrasting inclusions: 10 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Deford soils
- The somewhat poorly drained Ingalls soils

*Similar inclusions:*

- Soils that have a surface layer of loam

### **Use and Management**

*Dominant land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, plant competition, seasonal wetness, seedling mortality, windthrow hazard

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Carefully managed reforestation helps to control undesirable understory plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

#### **Building sites**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Ponding

*Management considerations:*

- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* 5W

*Michigan soil management group:* 3c-s

## **429D—Menominee sand, 12 to 18 percent slopes**

### **Setting**

*Landform:* Till plains and moraines

*Shape of areas:* Linear

*Size of areas:* 5 to 50 acres

### Typical Profile

#### Surface layer:

0 to 4 inches—very dark grayish brown sand

#### Subsurface layer:

4 to 7 inches—grayish brown sand

#### Subsoil:

7 to 18 inches—dark brown, very friable sand

18 to 23 inches—dark yellowish brown, very friable sand

23 to 39 inches—brown, firm clay loam and light brownish gray sandy loam

39 to 59 inches—reddish brown, firm clay loam

#### Substratum:

59 to 80 inches—brown loam

### Soil Properties and Qualities

*Permeability:* Rapid in the sandy part and moderately slow in the loamy part

*Available water capacity:* Moderate

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Moderate

*Potential for frost action:* Low

### Composition

Menominee soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

### Inclusions

#### Contrasting inclusions:

- The well drained, loamy Curtisville soils

#### Similar inclusions:

- Soils that have clay loam till at a depth of more than 40 inches
- Soils that have a lighter colored subsoil

### Use and Management

*Dominant land use:* Woodland

#### Woodland

*Major management concerns:* Equipment limitations, seedling mortality, plant competition, seasonal droughtiness

#### Management considerations:

- The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of

wheeled equipment, logging roads should be stabilized.

- Planting when the soil is moist can reduce the seedling mortality rate.
- Carefully managed reforestation helps to control undesirable understory plants.

### Building sites

*Major management concerns:* Cutbanks caving, slope

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Because of the slope, this soil is poorly suited to building site development unless extensive land shaping is feasible.

### Septic tank absorption fields

*Major management concerns:* Rapid permeability, slope, restricted permeability

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### Interpretive Groups

*Land capability classification:* IVe

*Woodland ordination symbol:* 6S

*Michigan soil management group:* 4/2a

### 430D—Mongo loam, 12 to 18 percent slopes

#### Setting

*Landform:* Dissected lake plains

*Shape of areas:* Linear

*Size of areas:* 10 to 50 acres

#### Typical Profile

#### Surface layer:

0 to 5 inches—very dark grayish brown loam

#### Subsoil:

5 to 8 inches—dark brown, firm silty clay and light brownish gray, firm silty clay loam

8 to 12 inches—dark brown, firm silty clay and brown, firm silty clay loam

12 to 21 inches—dark brown, firm silty clay  
 21 to 55 inches—brown, firm silty clay loam

**Substratum:**

55 to 80 inches—stratified brown and reddish brown silty clay loam

**Soil Properties and Qualities**

*Permeability:* Very slow

*Available water capacity:* High

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* High

*Potential for frost action:* Moderate

**Composition**

Mongo soil and similar soils: 90 to 95 percent

Contrasting inclusions: 5 to 10 percent

**Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained, sandy over clayey Allendale soils
- The moderately well drained Negwegon soils

*Similar inclusions:*

- Soils that have a surface layer of clay loam
- Soils that have a surface layer of sandy loam

**Use and Management**

*Dominant land use:* Pasture

*Other uses:* Woodland

**Pasture**

*Major management concerns:* Compaction

*Management considerations:*

- Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

**Woodland**

*Major management concerns:* Erosion hazard, equipment limitations, plant competition, slope, windthrow hazard

*Management considerations:*

- Because of the restricted permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.

- The grade should be kept as low as possible.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

**Building sites**

*Major management concerns:* Shrink-swell, slope

*Management considerations:*

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Because of the slope, this soil is poorly suited to building site development unless extensive land shaping is feasible.

**Septic tank absorption fields**

*Major management concerns:* Restricted permeability, slope

*Management considerations:*

- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

**Interpretive Groups**

*Land capability classification:* IVe

*Woodland ordination symbol:* 3R

*Michigan soil management group:* 1a

**430E—Mongo loam, 18 to 35 percent slopes**

**Setting**

*Landform:* Lake plains

*Shape of areas:* Linear

*Size of areas:* 5 to 40 acres

**Typical Profile**

*Surface layer:*

0 to 5 inches—very dark grayish brown loam

*Subsoil:*

5 to 8 inches—dark brown, firm silty clay and light brownish gray, firm silty clay loam

8 to 12 inches—dark brown, firm silty clay and brown, firm silty clay loam

12 to 21 inches—dark brown, firm silty clay  
 21 to 55 inches—brown, firm silty clay loam

**Substratum:**

55 to 80 inches—stratified brown and reddish brown silty clay loam

**Soil Properties and Qualities**

*Permeability:* Very slow

*Available water capacity:* High

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Very rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Slight

*Shrink-swell potential:* High

*Potential for frost action:* Moderate

**Composition**

Mongo soil and similar soils: 90 to 95 percent

Contrasting inclusions: 5 to 10 percent

**Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained, sandy over clayey Allendale soils
- The moderately well drained Negwegon soils

*Similar inclusions:*

- Soils that have a surface layer of clay loam
- Soils that have a surface layer of sandy loam

**Use and Management**

*Dominant land use:* Pasture

*Other uses:* Woodland

**Pasture**

*Major management concerns:* Compaction

*Management considerations:*

- Proper stocking rates, uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

**Woodland**

*Major management concerns:* Erosion hazard, equipment limitations, plant competition, slope, windthrow hazard

*Management considerations:*

- Because of the slope, special care is needed in laying out logging roads and landings and in operating

logging equipment. Logging roads should be designed so that they conform to the topography.

- The grade should be kept as low as possible.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- Because of the restricted permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

**Building sites**

*Major management concerns:* Slope

*Management considerations:*

- Because of the slope, this soil is generally unsuited to building site development.

**Septic tank absorption fields**

*Major management concerns:* Slope

*Management considerations:*

- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

**Interpretive Groups**

*Land capability classification:* VIIe

*Woodland ordination symbol:* 3R

*Michigan soil management group:* 1a

**431B—Skeel loamy sand, 0 to 6 percent slopes**

**Setting**

*Landform:* Lake plains

*Shape of areas:* Irregular

*Size of areas:* 10 to 100 acres

**Typical Profile**

*Surface layer:*

0 to 8 inches—very dark grayish brown loamy sand

**Subsurface layer:**

8 to 11 inches—light brownish gray sand

**Subsoil:**

11 to 18 inches—brown, loose sand with columns of brown and very dark brown, weakly cemented to strongly cemented sand

18 to 29 inches—strong brown, mottled, loose sand with columns of weakly cemented to moderately cemented sand

29 to 36 inches—yellowish brown, mottled, loose sand

36 to 45 inches—reddish brown, mottled, firm clay loam

**Substratum:**

45 to 80 inches—brown, mottled clay loam

**Soil Properties and Qualities**

**Permeability:** Rapid in the sandy part and moderately slow in the loamy part

**Available water capacity:** Moderate

**Drainage class:** Moderately well drained

**Seasonal high water table:** Perched at a depth of 2.0 to 3.5 feet at some time from November through May

**Surface runoff:** Very slow

**Flooding:** None

**Hazard of water erosion:** Slight

**Hazard of soil blowing:** Moderate

**Shrink-swell potential:** Moderate

**Potential for frost action:** Low

**Composition**

Skeel soil and similar soils: 85 to 90 percent

Contrasting inclusions: 10 to 15 percent

**Inclusions****Contrasting inclusions:**

- The somewhat poorly drained Manary soils
- The poorly drained Springport soils

**Similar inclusions:**

- Soils that have a lighter colored subsoil
- Soils in which the subsoil is at a lower depth

**Use and Management**

**Dominant land use:** Cropland

**Other uses:** Pasture; woodland

**Cropland**

**Major management concerns:** Seasonal droughtiness, soil blowing

**Management considerations:**

- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover

crops, and crop rotations that include small grain and hay help to control soil blowing. Maintaining a permanent plant cover also helps to control soil blowing.

- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.

**Pasture**

**Major management concerns:** Overgrazing, seasonal droughtiness

**Management considerations:**

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to soil tests can help to ensure the maximum growth of plants, especially legumes.

**Woodland**

**Major management concerns:** Equipment limitations, plant competition, seasonal droughtiness, seedling mortality

**Management considerations:**

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting seedlings that can withstand droughty conditions can also reduce the seedling mortality rate. Replanting is needed in some areas.
- Special harvest methods may be needed to control undesirable plants.
- Carefully managed reforestation helps to control undesirable understory plants.

**Building sites**

**Major management concerns:** Cutbanks caving, seasonal wetness, shrink-swell

**Management considerations:**

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

### Septic tank absorption fields

*Major management concerns:* Restricted permeability, seasonal wetness

*Management considerations:*

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- A subsurface drainage system helps to lower the water table.

### Interpretive Groups

*Land capability classification:* IIIs

*Woodland ordination symbol:* 3S

*Michigan soil management group:* 4/2a

### 432B—Wurtsmith-Meehan sands, 0 to 6 percent slopes

#### Setting

*Landform:* Beach ridges on lake plains

*Slope range:* Wurtsmith—0 to 6 percent; Meehan—0 to 3 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 100 acres

#### Typical Profile

##### Wurtsmith

*Surface layer:*

0 to 1 inch—black, partially decomposed leaf litter

*Subsurface layer:*

1 to 4 inches—grayish brown sand

*Subsoil:*

4 to 14 inches—yellowish brown, very friable sand  
14 to 24 inches—brownish yellow, very friable sand

*Substratum:*

24 to 80 inches—pale brown and brown, mottled sand

##### Meehan

*Surface layer:*

0 to 2 inches—very dark gray sand

*Subsurface layer:*

2 to 9 inches—pale brown sand

*Subsoil:*

9 to 21 inches—brown and yellowish brown, mottled, very friable sand

21 to 43 inches—light yellowish brown, mottled, loose sand

*Substratum:*

43 to 80 inches—brown sand

### Soil Properties and Qualities

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Wurtsmith—moderately well drained; Meehan—somewhat poorly drained

*Seasonal high water table:* Wurtsmith—apparent, at a depth of 2.0 to 3.5 feet at some time from November through May; Meehan—apparent, at a depth of 1 to 3 feet at some time from October through June

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Wurtsmith—low; Meehan—moderate

### Composition

Wurtsmith soil and similar soils: 40 to 50 percent

Meehan soil and similar soils: 30 to 40 percent

Contrasting inclusions: 10 to 25 percent

### Inclusions

*Contrasting inclusions:*

- The very poorly drained Deford soils
- The excessively drained Grayling soils

*Similar inclusions:*

- Soils that have a darker subsoil

### Use and Management

*Dominant land use:* Woodland

#### Woodland

*Major management concerns:* Wurtsmith—equipment limitations, seedling mortality, windthrow hazard, seasonal droughtiness; Meehan—equipment limitations, seedling mortality, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate in areas of the Wurtsmith soil. Replanting is needed in some areas.

- Planting when the soil is moist can reduce the seedling mortality rate in areas of the Wurtsmith soil.
- In areas of the Meehan soil, the seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Trees that can withstand seasonal wetness should be selected for planting on the Meehan soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants in areas of the Meehan soil.
- Special harvest methods may be needed to control undesirable plants in areas of the Meehan soil.

### Building sites

*Major management concerns:* Seasonal wetness, cutbanks caving

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

### Septic tank absorption fields

*Major management concerns:* Rapid permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of these soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

### Interpretive Groups

*Land capability classification:* IVs

*Woodland ordination symbol:* Wurtsmith—6S;  
Meehan—5W

*Michigan soil management group:* Wurtsmith—5a;  
Meehan—5b

## 433B—Morganlake-Graycalm sands, 0 to 6 percent slopes

### Setting

*Landform:* Till plains

*Shape of areas:* Irregular

*Size of areas:* 10 to 100 acres

### Typical Profile

#### Morganlake

*Surface layer:*

0 to 4 inches—black sand

*Subsurface layer:*

4 to 6 inches—light brownish gray sand

*Subsoil:*

6 to 13 inches—dark brown, friable sand

13 to 23 inches—brown, very friable sand

23 to 29 inches—light brownish gray, mottled, very friable loamy sand

29 to 47 inches—dark brown, mottled, firm clay loam and pinkish gray, very friable sandy loam

*Substratum:*

47 to 80 inches—reddish brown, mottled clay loam

#### Graycalm

*Surface layer:*

0 to 4 inches—black sand

*Subsoil:*

4 to 16 inches—strong brown, friable sand

16 to 45 inches—yellowish brown, brownish yellow, and yellow, very friable sand

*Substratum:*

45 to 80 inches—very pale brown sand with bands of strong brown loamy sand

### Soil Properties and Qualities

*Permeability:* Morganlake—rapid in the sandy part and moderately slow in the loamy part; Graycalm—rapid

*Available water capacity:* Morganlake—moderate; Graycalm—low

*Drainage class:* Morganlake—moderately well drained; Graycalm—somewhat excessively drained

*Seasonal high water table:* Morganlake—perched at a depth of 2.0 to 3.5 feet at some time from October through May; Graycalm—at a depth of more than 6 feet

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Morganlake—moderate;  
Graycalm—low

*Potential for frost action:* Morganlake—moderate;  
Graycalm—low

### **Composition**

Morganlake soil and similar soils: 40 to 50 percent

Graycalm soil and similar soils: 40 to 50 percent

Contrasting inclusions: 0 to 20 percent

### **Inclusions**

*Contrasting inclusions:*

- The moderately well drained, loamy Nester soils

*Similar inclusions:*

- Soils that do not have bands of loamy sand in the substratum
- Soils that have a lighter colored subsoil

### **Use and Management**

*Dominant land use:* Woodland

#### **Woodland**

*Major management concerns:* Morganlake—equipment limitations, seedling mortality, seasonal droughtiness, plant competition; Graycalm—equipment limitations, seedling mortality, seasonal droughtiness

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings or planting seedlings that can withstand droughty conditions can also reduce the seedling mortality rate. Replanting is needed in some areas.
- Carefully managed reforestation helps to control undesirable understory plants in areas of the Morganlake soil.
- Special harvest methods may be needed in areas of the Morganlake soil to control undesirable plants.

#### **Building sites**

*Major management concerns:* Morganlake—cutbanks caving, seasonal wetness, shrink-swell;  
Graycalm—cutbanks caving

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- In areas of the Morganlake soil, buildings can be

constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

- In areas of the Morganlake soil, wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling of the Morganlake soil.

#### **Septic tank absorption fields**

*Major management concerns:* Morganlake—rapid permeability, restricted permeability, seasonal wetness; Graycalm—rapid permeability

*Management considerations:*

- The poor filtering capacity of these soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability in the lower part of the Morganlake soil.
- Filling or mounding with suitable material helps to raise the absorption field above the water table in areas of the Morganlake soil.

### **Interpretive Groups**

*Land capability classification:* IIIs

*Woodland ordination symbol:* 6S

*Michigan soil management group:* Morganlake—4/2a;  
Graycalm—5a

## **434D—Graycalm-Menominee-Morganlake sands, 6 to 18 percent slopes**

### **Setting**

*Landform:* Till plains

*Slope range:* Graycalm—6 to 18 percent;

Menominee—12 to 18 percent; Morganlake—6 to 12 percent

*Shape of areas:* Irregular

*Size of areas:* 25 to 200 acres

### **Typical Profile**

#### **Graycalm**

*Surface layer:*

0 to 4 inches—black sand

*Subsoil:*

4 to 16 inches—strong brown, friable sand

16 to 45 inches—yellowish brown, brownish yellow, and yellow, very friable sand

*Substratum:*

45 to 80 inches—very pale brown sand with bands of strong brown loamy sand

**Menominee**

*Surface layer:*

0 to 4 inches—very dark grayish brown sand

*Subsurface layer:*

4 to 7 inches—grayish brown sand

*Subsoil:*

7 to 23 inches—dark brown and dark yellowish brown, very friable sand

23 to 39 inches—brown, firm clay and light brownish gray sandy loam

39 to 59 inches—reddish brown, firm clay loam

*Substratum:*

59 to 80 inches—brown loam

**Morganlake**

*Surface layer:*

0 to 4 inches—black sand

*Subsurface layer:*

4 to 6 inches—light brownish gray sand

*Subsoil:*

6 to 13 inches—dark brown, friable sand

13 to 23 inches—brown, very friable sand

23 to 29 inches—light brownish gray loamy sand

29 to 47 inches—dark brown, firm, mottled clay loam and pinkish gray, very friable sandy loam

*Substratum:*

47 to 80 inches—reddish brown, mottled clay loam

**Soil Properties and Qualities**

*Permeability:* Graycalm—rapid; Menominee and Morganlake—rapid in the sandy part and moderately slow in the loamy part

*Available water capacity:* Graycalm—low; Menominee and Morganlake—moderate

*Drainage class:* Graycalm—somewhat excessively drained; Menominee—well drained; Morganlake—moderately well drained

*Seasonal high water table:* Graycalm and Menominee—at a depth of more than 6 feet; Morganlake—perched at a depth of 2.0 to 3.5 feet at some time from October through May

*Surface runoff:* Graycalm and Menominee—medium; Morganlake—slow

*Flooding:* None

*Hazard of water erosion:* Graycalm and Morganlake—moderate; Menominee—severe

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Graycalm—low; Menominee and Morganlake—moderate

*Potential for frost action:* Low

**Composition**

Graycalm soil and similar soils: 30 to 40 percent

Menominee soil and similar soils: 25 to 35 percent

Morganlake soil and similar soils: 25 to 35 percent

Contrasting inclusions: 0 to 20 percent

**Inclusions**

*Contrasting inclusions:*

- The moderately well drained, loamy Nester soils

*Similar inclusions:*

- Soils that do not have bands of loamy sand in the substratum
- Soils that have a lighter colored subsoil

**Use and Management**

*Dominant land use:* Woodland

**Woodland**

*Major management concerns:* Graycalm—equipment limitations, seedling mortality, seasonal droughtiness, erosion hazard; Menominee and Morganlake—equipment limitations, seedling mortality, seasonal droughtiness, plant competition

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings or planting seedlings that can withstand droughty conditions can also reduce the seedling mortality rate. Replanting is needed in some areas.
- In areas of the Graycalm soil, the risk of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Carefully managed reforestation helps to control undesirable understory plants in areas of the Menominee and Morganlake soils.
- Special harvest methods may be needed to control undesirable plants in areas of the Menominee and Morganlake soils.

**Building sites**

*Major management concerns:* Graycalm and Menominee—cutbanks caving, slope;

Morganlake—cutbanks caving, slope, seasonal wetness, shrink-swell

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Because of the slope, these soils are poorly suited to building site development unless extensive land shaping is feasible.
- In areas of the Morganlake soil, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- In areas of the Morganlake soil, wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling of the Morganlake soil.

**Septic tank absorption fields**

*Major management concerns:* Graycalm—rapid permeability, slope; Menominee—rapid permeability, slope, restricted permeability; Morganlake—rapid permeability, slope, restricted permeability, seasonal wetness

*Management considerations:*

- The poor filtering capacity of these soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability in the lower part of the Menominee and Morganlake soils.
- Filling or mounding with suitable material helps to raise the absorption field above the water table in areas of the Morganlake soil.

**Interpretive Groups**

*Land capability classification:* VIs

*Woodland ordination symbol:* 6S

*Michigan soil management group:* Graycalm—5a; Menominee—4/2a; Morganlake—4/2a

**435B—Skeel-Algonquin-Aquepts complex, 0 to 6 percent slopes**

**Setting**

*Landform:* Lake plains

*Slope range:* Skeel—0 to 6 percent; Algonquin—0 to 3 percent; Aquepts—0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 200 acres

**Typical Profile**

**Skeel**

*Surface layer:*

0 to 8 inches—very dark grayish brown loamy sand

*Subsurface layer:*

8 to 11 inches—light brownish gray sand

*Subsoil:*

11 to 18 inches—brown, loose sand with columns of brown and very dark brown, weakly cemented to strongly cemented sand

18 to 29 inches—strong brown, mottled, loose sand with columns of weakly cemented to moderately cemented sand

29 to 36 inches—yellowish brown, mottled, loose sand  
36 to 45 inches—reddish brown, mottled, firm clay loam

*Substratum:*

45 to 80 inches—brown, mottled clay loam

**Algonquin**

*Surface layer:*

0 to 9 inches—very dark grayish brown clay

*Subsoil:*

9 to 17 inches—brown and reddish brown, mottled, firm clay

*Substratum:*

17 to 80 inches—reddish brown, mottled clay

**Aquepts**

*Surface layer:*

0 to 8 inches—black sandy loam

*Subsoil:*

8 to 30 inches—grayish brown, friable clay loam

*Substratum:*

30 to 80 inches—light brownish gray clay loam

**Soil Properties and Qualities**

*Permeability:* Skeel—rapid in the sandy part and moderately slow in the loamy part; Algonquin—very slow; Aquepts—moderate

*Available water capacity:* Moderate

*Drainage class:* Skeel—moderately well drained; Algonquin—somewhat poorly drained; Aquepts—very poorly drained

*Seasonal high water table:* Skeel—perched at a depth of 2.0 to 3.5 feet at some time from November through May; Algonquin—perched at a depth of 0.5 foot to 1.5 feet at some time from October

through May; Aquepts—perched at the surface to 1 foot above the surface at some time from January through December

*Surface runoff:* Skeel—very slow; Algonquin—slow; Aquepts—ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Skeel—moderate; Algonquin—high; Aquepts—moderate

*Potential for frost action:* Skeel—low; Algonquin and Aquepts—high

### **Composition**

Skeel soil and similar soils: 30 to 40 percent

Algonquin soil and similar soils: 30 to 40 percent

Aquepts and similar soils: 20 to 30 percent

Contrasting inclusions: 10 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained, sandy over clayey Wakeley soils
- The clayey, moderately well drained largo soils

*Similar inclusions:*

- Soils that do not have cementation in the subsoil
- Soils that have a surface layer of sand

### **Use and Management**

*Dominant land use:* Pasture

*Other uses:* Woodland

#### **Pasture**

*Major management concerns:* Skeel—overgrazing, seasonal droughtiness; Algonquin—compaction, seasonal wetness; Aquepts—ponding

*Management considerations:*

- In areas of the Skeel soil, proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- In areas of the Algonquin soil, proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded in areas of the Algonquin soil.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth in areas of the Algonquin soil.

#### **Woodland**

*Major management concerns:* Skeel—equipment limitations, seedling mortality, plant competition, seasonal droughtiness; Algonquin—equipment

limitations, seedling mortality, plant competition, windthrow hazard, seasonal wetness; Aquepts—equipment limitations, seedling mortality, plant competition, seasonal wetness

*Management considerations:*

- Because loose sand in areas of the Skeel soil can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Because of the restricted permeability and the sticky and plastic subsoil of the Algonquin soil, logging roads should be graveled and in some areas landings should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate in areas of the Skeel soil.
- Trees that can withstand seasonal wetness should be selected for planting on the Algonquin soil.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- In areas of the Algonquin soil, windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Aquepts.

#### **Building sites**

*Major management concerns:* Skeel—cutbanks caving, seasonal wetness, shrink-swell; Algonquin—seasonal wetness, shrink-swell; Aquepts—ponding

*Management considerations:*

- Because cutbanks in areas of the Skeel soil are not stable and are subject to caving, trench walls should be reinforced.
- In areas of the Skeel and Algonquin soils, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness in areas of the Skeel and Algonquin soils can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling of the Skeel and Algonquin soils.
- Because of ponding, the Aquepts are generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Skeel—seasonal wetness, restricted permeability; Algonquin—

seasonal wetness, restricted permeability;

Aquepts—ponding

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table in areas of the Skeel and Algonquin soils.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability of the Skeel and Algonquin soils.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability of the Skeel and Algonquin soils.
- Because of ponding, the Aquepts are generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* IIIs

*Woodland ordination symbol:* Skeel—3S; Algonquin—6W; Aquepts—none assigned

*Michigan soil management group:* Skeel—4/2a; Algonquin—1b; Aquepts—none assigned

## **436A—Manary-Whitemore-Springport complex, 0 to 3 percent slopes**

### **Setting**

*Landform:* Lake plains

*Slope range:* Manary and Whitemore—0 to 3 percent; Springport—0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 10 to 100 acres

### **Typical Profile**

#### **Manary**

*Surface layer:*

0 to 11 inches—black silty clay loam

*Subsoil:*

11 to 18 inches—brown, mottled, firm silty clay

*Substratum:*

18 to 29 inches—reddish brown, mottled silty clay loam

29 to 80 inches—brown and reddish brown silty clay loam with strata of brown and pale brown loamy very fine sand

#### **Whitemore**

*Surface layer:*

0 to 9 inches—very dark gray sand

*Subsurface layer:*

9 to 12 inches—light grayish brown and light gray sand

*Subsoil:*

12 to 17 inches—dark reddish brown, mottled, strongly cemented, firm sand

17 to 35 inches—yellowish brown and light yellowish brown, mottled, loose sand

35 to 44 inches—light reddish brown, mottled, firm silty clay

*Substratum:*

44 to 80 inches—reddish brown, mottled silty clay

#### **Springport**

*Surface layer:*

0 to 10 inches—very dark gray silty clay loam

*Subsoil:*

10 to 36 inches—dark gray, mottled, firm silty clay loam

*Substratum:*

36 to 80 inches—reddish brown, mottled silty clay loam and silt loam

### **Soil Properties and Qualities**

*Permeability:* Manary—slow; Whitemore—moderate in the sandy part and very slow in the clayey part; Springport—very slow

*Available water capacity:* Manary—moderate; Whitemore—low; Springport—high

*Drainage class:* Manary and Whitemore—somewhat poorly drained; Springport—poorly drained

*Seasonal high water table:* Manary and Whitemore—perched at a depth of 0.5 foot to 1.5 feet at some time from October through May; Springport—perched 1 foot above to 1 foot below the surface at some time from October through June

*Surface runoff:* Manary—slow; Whitemore—very slow; Springport—very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Manary—moderate; Whitemore—severe; Springport—slight

*Shrink-swell potential:* High

*Potential for frost action:* Manary—high; Whitemore—moderate; Springport—high

### **Composition**

Manary soil and similar soils: 30 to 40 percent

Whitemore soil and similar soils: 30 to 40 percent

Springport soil and similar soils: 20 to 30 percent

Contrasting inclusions: 10 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The moderately poorly drained large soils
- The moderately well drained Skeel soils

- The very poorly drained Tawas soils

*Similar inclusions:*

- Sandy soils that have a lighter colored subsoil
- Soils that have a mucky surface layer
- Sandy soils that do not have cementation in the subsoil

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Cropland, pasture

#### **Cropland**

*Major management concerns:* Manary—seasonal wetness, restricted permeability; Whittemore—seasonal wetness, restricted permeability, soil blowing, nutrient and pesticide loss; Springport—seasonal wetness, restricted permeability, tilth of the surface layer, soil compaction

*Management considerations:*

- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Shallow surface ditches help to remove surface water after heavy rains.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing in areas of the Whittemore soil. Maintaining a permanent plant cover also helps to control soil blowing.
- Because of the risk of ground-water pollution in areas of the Whittemore soil, nutrients in manure and fertilizer applications should not exceed the requirements of the plants.

#### **Pasture**

*Major management concerns:* Manary and Whittemore—seasonal wetness; Springport—seasonal wetness, compaction

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

#### **Woodland**

*Major management concerns:* Equipment limitations,

plant competition, seedling mortality, windthrow hazard, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has adequate snow cover.
- Trees that can withstand seasonal wetness should be selected for planting on the Manary and Whittemore soils.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Springport soil.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

#### **Building sites**

*Major management concerns:* Manary—seasonal wetness, shrink-swell; Whittemore—cutbanks caving, seasonal wetness, shrink-swell; Springport—ponding

*Management considerations:*

- Because cutbanks in areas of the Whittemore soil are not stable and are subject to caving, trench walls should be reinforced.
- In areas of the Manary and Whittemore soils, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness in areas of the Manary and Whittemore soils can be reduced by installing a drainage system around structures with basements and crawl spaces.
- In areas of the Manary and Whittemore soils, properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Because of ponding, the Springport soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Manary—seasonal wetness, restricted permeability; Whittemore—seasonal wetness, rapid permeability, restricted permeability; Springport—ponding

*Management considerations:*

- The poor filtering capacity of the Whittemore soil can result in the pollution of ground water.

- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- In areas of the Manary and Whittemore soils, filling or mounding with suitable fill material helps to raise the absorption field above the water table.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability in the Manary soil and in the lower part of the Whittemore soil.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability in the Manary soil and in the lower part of the Whittemore soil.
- Because of ponding, the Springport soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* Ilw

*Woodland ordination symbol:* Manary—4C;

Whittemore—4W; Springport—6W

*Michigan soil management group:* Manary—1.5b;

Whittemore—5/2b; Springport—1c

## **437D—Wurtsmith-Meehan-Deer Park sands, 0 to 18 percent slopes**

### **Setting**

*Landform:* Beach ridges on lake plains

*Slope range:* Wurtsmith—0 to 12 percent; Meehan—0 to 3 percent; Deer Park—6 to 18 percent

*Shape of areas:* Irregular or linear

*Size of areas:* 20 to 300 acres

### **Typical Profile**

#### **Wurtsmith**

*Surface layer:*

0 to 1 inch—black, partially decomposed leaf litter

*Subsurface layer:*

1 to 4 inches—grayish brown sand

*Subsoil:*

4 to 14 inches—yellowish brown, very friable sand

14 to 24 inches—brownish yellow, mottled, very friable sand

*Substratum:*

24 to 80 inches—pale brown and brown sand

#### **Meehan**

*Surface layer:*

0 to 2 inches—very dark gray sand

*Subsurface layer:*

2 to 9 inches—pale brown sand

*Subsoil:*

9 to 43 inches—brown, yellowish brown, and light yellowish brown, mottled, very friable sand

*Substratum:*

43 to 80 inches—brown sand

#### **Deer Park**

*Surface layer:*

0 to 1 inch—black, well decomposed leaf litter

*Subsurface layer:*

1 to 6 inches—gray sand

*Subsoil:*

6 to 10 inches—dark yellowish brown, very friable sand

10 to 18 inches—light yellowish brown, yellowish brown, and brownish yellow, very friable sand

*Substratum:*

18 to 80 inches—pale brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Wurtsmith—moderately well drained; Meehan—somewhat poorly drained; Deer Park—excessively drained

*Seasonal high water table:* Wurtsmith—apparent, at a depth of 2.0 to 3.5 feet at some time from November through May; Meehan—apparent, at a depth of 1 to 3 feet at some time from October through June; Deer Park—at a depth of more than 6 feet

*Surface runoff:* Wurtsmith—very slow or slow;

Meehan—very slow; Deer Park—medium

*Flooding:* None

*Hazard of water erosion:* Wurtsmith and Meehan—slight; Deer Park—moderate

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Wurtsmith—low; Meehan—moderate; Deer Park—low

### **Composition**

Wurtsmith soil and similar soils: 30 to 40 percent

Meehan soil and similar soils: 30 to 40 percent

Deer Park soil and similar soils: 25 to 30 percent

Contrasting inclusions: 15 to 25 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Deford soils

*Similar inclusions:*

- Soils that have a darker subsoil

**Use and Management**

*Dominant land use:* Woodland

**Woodland**

*Major management concerns:* Wurtsmith—equipment limitations, seedling mortality, seasonal droughtiness; Meehan—equipment limitations, seedling mortality, seasonal wetness, plant competition, windthrow hazard; Deer Park—equipment limitations, seedling mortality, seasonal droughtiness, slope

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate in areas of the Wurtsmith and Deer Park soils. Replanting is needed in some areas.
- Planting when the soil is moist can reduce the seedling mortality rate in areas of the Wurtsmith and Deer Park soils.
- In areas of the Meehan soil, the seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Trees that can withstand seasonal wetness should be selected for planting on the Meehan soil.
- In areas of the Meehan soil, windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants in areas of the Meehan soil.
- Special harvest methods may be needed to control undesirable plants in areas of the Meehan soil.

**Building sites**

*Major management concerns:* Wurtsmith and Meehan—cutbanks caving, seasonal wetness; Deer Park—cutbanks caving

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings in areas of the Wurtsmith and Meehan soils can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness in areas of the Wurtsmith and Meehan

soils can be reduced by installing a drainage system around structures with basements and crawl spaces.

**Septic tank absorption fields**

*Major management concerns:* Wurtsmith and Meehan—rapid permeability, seasonal wetness; Deer Park—rapid permeability

*Management considerations:*

- The poor filtering capacity of these soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table in areas of the Wurtsmith and Meehan soils.

**Interpretive Groups**

*Land capability classification:* IVs

*Woodland ordination symbol:* Wurtsmith—6S; Meehan—5W; Deer Park—4S

*Michigan soil management group:* Wurtsmith—5a; Meehan—5b; Deer Park—5.3a

**438C—Meehan-Tawas-Wurtsmith complex, 0 to 12 percent slopes****Setting**

*Landform:* Beach ridges on lake plains (fig. 11)

*Slope range:* Meehan—0 to 3 percent; Tawas—0 to 2 percent; Wurtsmith—0 to 12 percent

*Shape of areas:* Linear

*Size of areas:* 500 to 1,000 acres

**Typical Profile****Meehan**

*Surface layer:*

0 to 2 inches—very dark gray sand

*Subsurface layer:*

2 to 9 inches—pale brown sand

*Subsoil:*

9 to 43 inches—brown, yellowish brown, and light yellowish brown, mottled, very friable sand

*Substratum:*

43 to 80 inches—brown sand

**Tawas**

*Surface layer:*

0 to 12 inches—black muck

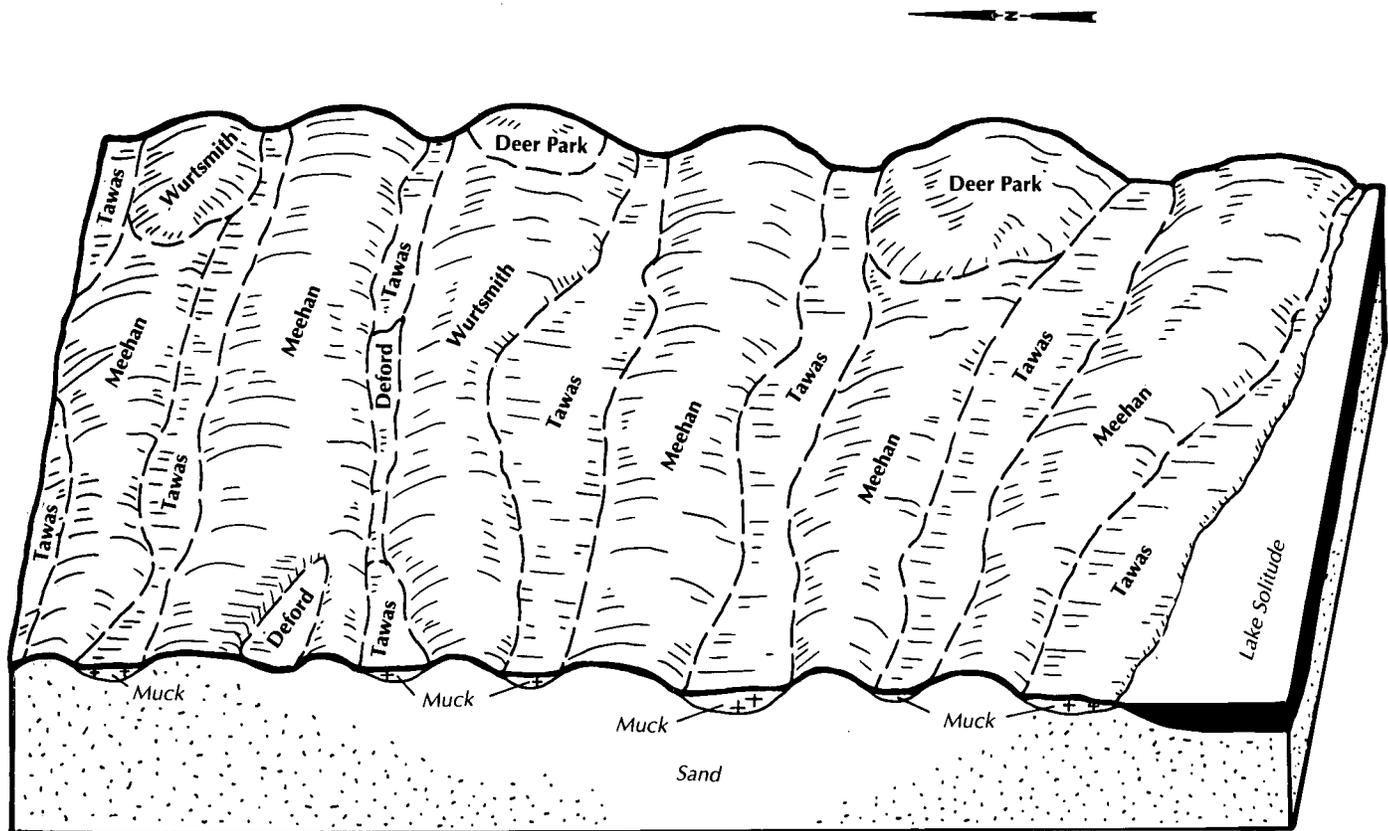


Figure 11.—Typical pattern of soils on the landscape in an area of Meehan-Tawas-Wurtsmith complex, 0 to 12 percent slopes.

*Subsoil:*

12 to 24 inches—black, very friable muck

*Substratum:*

24 to 80 inches—light brownish gray sand

**Wurtsmith**

*Surface layer:*

0 to 1 inch—black, partially decomposed leaf litter

*Subsurface layer:*

1 to 4 inches—grayish brown sand

*Subsoil:*

4 to 14 inches—yellowish brown, very friable sand

14 to 24 inches—brownish yellow, mottled, very friable sand

*Substratum:*

24 to 80 inches—pale brown and brown sand

**Soil Properties and Qualities**

*Permeability:* Meehan—rapid; Tawas—moderately slow to moderately rapid in the mucky part and rapid in the sandy part; Wurtsmith—rapid

*Available water capacity:* Meehan—low; Tawas—high; Wurtsmith—low

*Drainage class:* Meehan—somewhat poorly drained; Tawas—very poorly drained; Wurtsmith—moderately well drained

*Seasonal high water table:* Meehan—apparent, at a depth of 1 to 3 feet at some time from October through June; Tawas—apparent, 1 foot above to 1 foot below the surface at some time from October through May; Wurtsmith—apparent, at a depth of 2.0 to 3.5 feet at some time from November through May

*Surface runoff:* Meehan—very slow; Tawas—very slow or ponded; Wurtsmith—very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Meehan—severe; Tawas—moderate; Wurtsmith—severe

*Shrink-swell potential:* Low

*Potential for frost action:* Meehan—moderate; Tawas—high; Wurtsmith—low

**Composition**

Meehan soil and similar soils: 30 to 40 percent

Tawas soil and similar soils: 30 to 40 percent

Wurtsmith soil and similar soils: 25 to 30 percent

Contrasting inclusions: 15 to 25 percent

### ***Inclusions***

#### *Contrasting inclusions:*

- The very poorly drained Deford soils, which contain less than 8 inches of muck at the surface
- The excessively drained Deer Park soils

#### *Similar inclusions:*

- Soils that have a darker subsoil
- Soils that have 8 to 16 inches of muck at the surface

### ***Use and Management***

*Dominant land use:* Woodland

#### **Woodland**

*Major management concerns:* Meehan and Tawas—equipment limitations, seedling mortality, plant competition, seasonal wetness, windthrow hazard; Wurtsmith—equipment limitations, seedling mortality, seasonal droughtiness

#### *Management considerations:*

- Because loose sand in areas of the Meehan and Wurtsmith soils can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Because of wetness and low strength, special harvesting equipment is needed in areas of the Tawas soil. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate in areas of the Wurtsmith soil. Replanting is needed in some areas.
- Planting when the soil is moist can reduce the seedling mortality rate in areas of the Wurtsmith soil.
- In areas of the Meehan soil, the seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Trees that can withstand seasonal wetness should be selected for planting on the Meehan soil.
- In areas of the Meehan and Tawas soils, windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants in areas of the Meehan soil.
- Special harvest methods may be needed to control undesirable plants in areas of the Meehan soil.
- In areas of the Tawas soil, using selective cutting or cutting in strips and leaving desirable seed trees along

the edge of the openings are beneficial for natural regeneration.

- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Tawas soil.

#### **Building sites**

*Major management concerns:* Meehan and Wurtsmith—cutbanks caving, seasonal wetness, slope; Tawas—ponding

#### *Management considerations:*

- Because cutbanks in areas of the Meehan and Wurtsmith soils are not stable and are subject to caving, trench walls should be reinforced.
- In areas of the Meehan and Wurtsmith soils, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness in areas of the Meehan and Wurtsmith soils can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Buildings in the sloping areas of the Wurtsmith soil should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.
- Because of ponding, the Tawas soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Meehan and Wurtsmith—rapid permeability, seasonal wetness; Tawas—ponding

#### *Management considerations:*

- The poor filtering capacity of the Meehan and Wurtsmith soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- In areas of the Meehan and Wurtsmith soils, filling or mounding with suitable material helps to raise the absorption field above the water table.
- Because of ponding, the Tawas soil is generally unsuited to septic tank absorption fields.

### ***Interpretive Groups***

*Land capability classification:* IVw

*Woodland ordination symbol:* Meehan and Tawas—5W; Wurtsmith—6S

*Michigan soil management group:* Meehan—5b; Tawas—M/4c; Wurtsmith—5a

### 439D—Deer Park sand, 4 to 18 percent slopes

#### Setting

*Landform:* Beach ridges and dunes

*Shape of areas:* Linear

*Size of areas:* 25 to 2,000 acres

#### Typical Profile

*Surface layer:*

0 to 1 inch—black, well decomposed leaf litter

*Subsurface layer:*

1 to 6 inches—gray sand

*Subsoil:*

6 to 10 inches—dark yellowish brown, very friable sand

10 to 13 inches—yellowish brown and brownish yellow, very friable sand

13 to 18 inches—light yellowish brown and brownish yellow, very friable sand

*Substratum:*

18 to 80 inches—pale brown sand

#### Soil Properties and Qualities

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Excessively drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Low

#### Composition

Deer Park soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

#### Inclusions

*Contrasting inclusions:*

- The somewhat poorly drained Au Gres soils
- The very poorly drained Deford soils
- The moderately well drained Wurtsmith soils

*Similar inclusions:*

- Soils that have a darker subsoil
- Soils that have fine sand in the substratum

#### Use and Management

*Dominant land use:* Woodland

#### Woodland

*Major management concerns:* Seasonal droughtiness, equipment limitations, seedling mortality, slope

*Management considerations:*

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist can reduce the seedling mortality rate. Planting seedlings that can withstand droughty conditions can also reduce the seedling mortality rate. Replanting is needed in some areas.
- The grade should be kept as low as possible.

#### Building sites

*Major management concerns:* Cutbanks caving, slope

*Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Because of the slope, this soil is poorly suited to building site development unless extensive land shaping is feasible.

#### Septic tank absorption fields

*Major management concerns:* Rapid permeability, slope

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

#### Interpretive Groups

*Land capability classification:* VIIs

*Woodland ordination symbol:* 4S

*Michigan soil management group:* 5.3a

### 440B—Kawkawlin-Sims complex, 0 to 4 percent slopes

#### Setting

*Landform:* Till plains and moraines (fig. 12)

*Slope range:* Kawkawlin—0 to 4 percent; Sims—0 to 2 percent

*Shape of areas:* Irregular

*Size of areas:* 50 to 1,000 acres

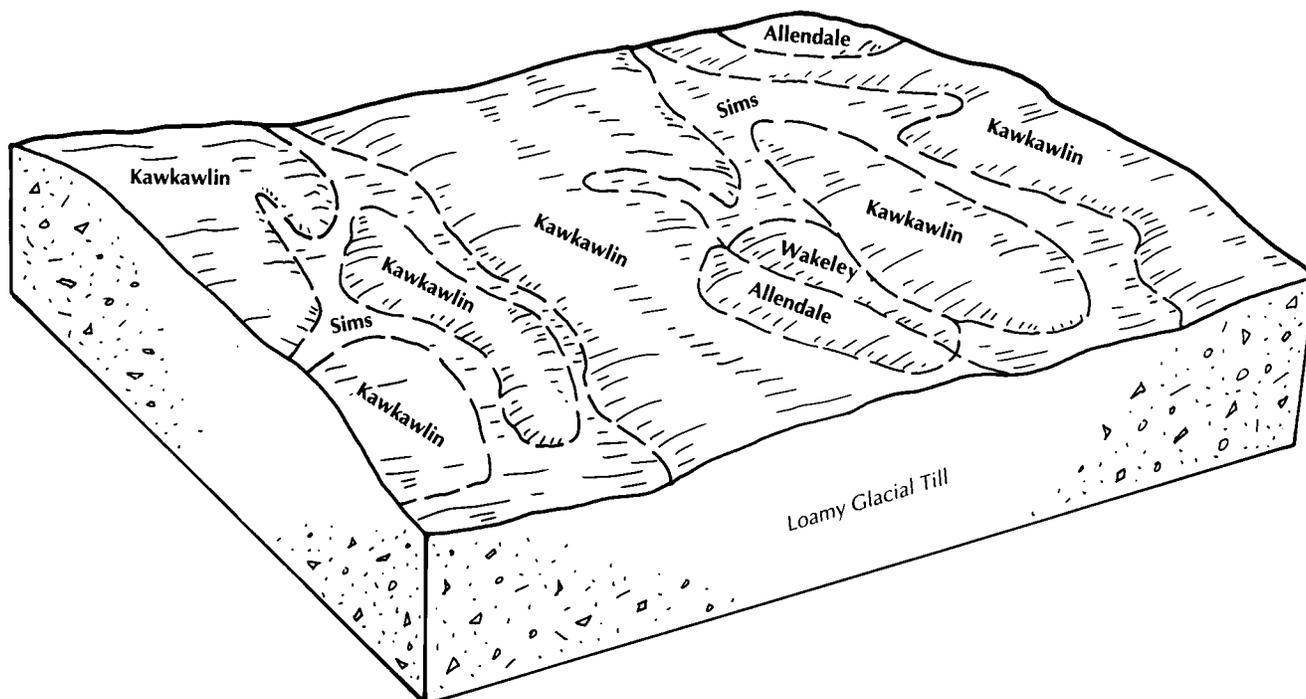


Figure 12.—Typical pattern of soils on the landscape in an area of Kawkawlin-Sims complex, 0 to 4 percent slopes.

**Typical Profile**

**Kawkawlin**

*Surface layer:*

0 to 6 inches—very dark grayish brown sandy loam

*Subsurface layer:*

6 to 8 inches—light brownish gray, mottled sandy loam

*Subsoil:*

8 to 13 inches—yellowish brown, mottled, friable sandy loam

13 to 18 inches—light brownish gray sandy loam and dark brown, mottled, friable clay loam

18 to 37 inches—light brown, mottled, friable clay loam

*Substratum:*

37 to 60 inches—brown sandy clay loam

60 to 80 inches—brown, mottled sandy clay loam

**Sims**

*Surface layer:*

0 to 5 inches—black loam

*Subsoil:*

5 to 13 inches—dark gray and gray, mottled, firm clay loam

13 to 47 inches—gray, mottled, firm clay loam

*Substratum:*

47 to 80 inches—light reddish brown, mottled clay loam

**Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* High

*Drainage class:* Kawkawlin—somewhat poorly drained; Sims—poorly drained

*Seasonal high water table:* Kawkawlin—perched at a depth of 0.5 foot to 1.5 feet at some time from October through May; Sims—perched 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Kawkawlin—medium; Sims—very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Kawkawlin—moderate; Sims—slight

*Hazard of soil blowing:* Kawkawlin—moderate; Sims—slight

*Shrink-swell potential:* Moderate

*Potential for frost action:* High

**Composition**

Kawkawlin soil and similar soils: 50 to 60 percent

Sims soil and similar soils: 25 to 30 percent

Contrasting inclusions: 10 to 20 percent

### **Inclusions**

#### *Contrasting inclusions:*

- The very poorly drained Wakeley soils
- The somewhat poorly drained, sandy over clayey Allendale soils

#### *Similar inclusions:*

- Soils that have a surface layer of sandy loam

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Cropland, pasture

#### **Cropland**

*Major management concerns:* Kawkawlin—restricted permeability, seasonal wetness, tilth in the surface layer, water erosion, nutrient and pesticide loss; Sims—restricted permeability, seasonal wetness, tilth in the surface layer, ponding, compaction

#### *Management considerations:*

- Both surface and subsurface drainage systems are needed to reduce the wetness.
- Because of the restricted permeability, subsurface drains should be narrowly spaced.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss in areas of the Kawkawlin soil.
- In areas of the Kawkawlin soil, conservation tillage systems, contour farming, cover crops, and sod-based rotations can minimize the detachment and loss of nutrients associated with sediment and thus help to prevent the loss of solid-phase nitrogen and phosphorus.

#### **Pasture**

*Major management concerns:* Seasonal wetness, overgrazing, compaction

#### *Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Applying lime and fertilizer according to soil tests can help to ensure the maximum growth of plants.

#### **Woodland**

*Major management concerns:* Kawkawlin—equipment limitations, windthrow hazard, plant competition, seasonal wetness; Sims—equipment limitations, windthrow hazard, plant competition, seasonal wetness, seedling mortality

#### *Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Trees that can withstand seasonal wetness should be selected for planting on the Kawkawlin soil.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on these soils.

#### **Building sites**

*Major management concerns:* Kawkawlin—seasonal wetness, shrink-swell; Sims—ponding

#### *Management considerations:*

- In areas of the Kawkawlin soil, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness in areas of the Kawkawlin soil can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Because of ponding, the Sims soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Kawkawlin—seasonal wetness, restricted permeability; Sims—ponding

#### *Management considerations:*

- In areas of the Kawkawlin soil, filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or

installing alternating drainfields helps to overcome the restricted permeability of the Kawkawlin soil.

- Backfilling the trenches with porous material helps to compensate for the restricted permeability of the Kawkawlin soil.
- Because of ponding, the Sims soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* Kawkawlin—3W; Sims—4W

*Michigan soil management group:* Kawkawlin—1.5b; Sims—1.5c

## **441B—Morganlake-Nester complex, 0 to 6 percent slopes**

### **Setting**

*Landform:* Till plains and moraines

*Slope range:* Morganlake—0 to 6 percent; Nester—1 to 6 percent

*Shape of areas:* Irregular

*Size of areas:* 50 to 300 acres

### **Typical Profile**

#### **Morganlake**

*Surface layer:*

0 to 4 inches—black sand

*Subsurface layer:*

4 to 6 inches—light brownish gray sand

*Subsoil:*

6 to 13 inches—dark brown, friable sand

13 to 23 inches—brown, very friable sand

23 to 29 inches—light brownish gray, mottled, very friable loamy sand

29 to 47 inches—dark brown, mottled, firm clay loam and pinkish gray, very friable sandy loam

*Substratum:*

47 to 80 inches—reddish brown, mottled clay loam

#### **Nester**

*Surface layer:*

0 to 11 inches—very dark grayish brown sandy loam

*Subsoil:*

11 to 17 inches—light grayish brown, friable sandy loam and dark brown clay loam

17 to 34 inches—brown, firm clay loam

*Substratum:*

34 to 50 inches—strong brown, mottled clay loam

50 to 80 inches—brown clay loam

### **Soil Properties and Qualities**

*Permeability:* Morganlake—rapid in the sandy part and moderately slow in the loamy part; Nester—slow

*Available water capacity:* Moderate

*Drainage class:* Moderately well drained

*Seasonal high water table:* Morganlake—perched at a depth of 2.0 to 3.5 feet at some time from October through May; Nester—perched at a depth of 2.5 to 3.5 feet at some time from November through May

*Surface runoff:* Morganlake—very slow; Nester—medium

*Flooding:* None

*Hazard of water erosion:* Morganlake—slight; Nester—moderate

*Hazard of soil blowing:* Morganlake—severe; Nester—moderate

*Shrink-swell potential:* Moderate

*Potential for frost action:* Morganlake—low; Nester—moderate

### **Composition**

Morganlake soil and similar soils: 45 to 55 percent

Nester soil and similar soils: 35 to 45 percent

Contrasting inclusions: 5 to 20 percent

### **Inclusions**

*Contrasting inclusions:*

- The poorly drained Sims soils
- The somewhat poorly drained Kokosing soils

*Similar inclusions:*

- Soils in which the depth to a loamy substratum is more than 40 inches

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Cropland, pasture

#### **Cropland**

*Major management concerns:* Morganlake—soil blowing, seasonal droughtiness; Nester—soil blowing, water erosion, soil compaction, tilth in the surface layer, restricted permeability, seasonal wetness

*Management considerations:*

- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. Maintaining a permanent plant cover also helps to control soil blowing.
- Minimizing tillage and tilling and harvesting at the

proper soil moisture content help to prevent excessive compaction and maintain tilth.

- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- In areas of the Nester soil, a system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- In areas of the Nester soil, most adapted crops can be grown if an adequate drainage system is installed.
- Because of the restricted permeability of the Nester soil, subsurface drains should be narrowly spaced.

### Pasture

*Major management concerns:* Morganlake—seasonal droughtiness; Nester—compaction

*Management considerations:*

- In areas of the Morganlake soil, proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- In areas of the Nester soil, proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth in areas of the Nester soil.

### Woodland

*Major management concerns:* Morganlake—equipment limitations, plant competition, seedling mortality, seasonal droughtiness; Nester—equipment limitations, plant competition

*Management considerations:*

- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Because loose sand in areas of the Morganlake soil can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- In areas of the Morganlake soil, planting seedlings that can withstand droughty conditions can reduce the seedling mortality rate. Planting when the soil is moist and planting special nursery stock or containerized seedlings can also reduce the seedling mortality rate. Replanting is needed in some areas.

- In areas of the Nester soil, skidders should not be used during wet periods, when ruts form easily.

### Building sites

*Major management concerns:* Morganlake—shrink-swell, seasonal wetness, cutbanks caving; Nester—shrink-swell, seasonal wetness

*Management considerations:*

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Because cutbanks in areas of the Morganlake soil are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

### Septic tank absorption fields

*Major management concerns:* Morganlake—restricted permeability, seasonal wetness, rapid permeability; Nester—restricted permeability, seasonal wetness

*Management considerations:*

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- The poor filtering capacity of the Morganlake soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

### Interpretive Groups

*Land capability classification:* IIIs

*Woodland ordination symbol:* Morganlake—6S; Nester—3L

*Michigan soil management group:* Morganlake—4/2a; Nester—1.5a

## 441C—Morganlake-Nester complex, 6 to 12 percent slopes

### Setting

*Landform:* Till plains and moraines

*Shape of areas:* Irregular

*Size of areas:* 25 to 50 acres

### Typical Profile

#### Morganlake

*Surface layer:*

0 to 4 inches—black sand

*Subsurface layer:*

4 to 6 inches—light brownish gray sand

*Subsoil:*

6 to 13 inches—dark brown, friable sand

13 to 23 inches—brown, very friable sand

23 to 29 inches—light brownish gray loamy sand

29 to 47 inches—dark brown, mottled, firm clay loam and pinkish gray, very friable sandy loam

*Substratum:*

47 to 80 inches—reddish brown, mottled clay loam

#### Nester

*Surface layer:*

0 to 11 inches—very dark grayish brown sandy loam

*Subsoil:*

11 to 17 inches—light grayish brown, friable sandy loam and dark brown clay loam

17 to 34 inches—brown, firm clay loam

*Substratum:*

34 to 50 inches—strong brown, mottled clay loam

50 to 80 inches—brown clay loam

### Soil Properties and Qualities

*Permeability:* Morganlake—rapid in the sandy part and moderately slow in the loamy part; Nester—slow

*Available water capacity:* Moderate

*Drainage class:* Moderately well drained

*Seasonal high water table:* Morganlake—perched at a depth of 2.0 to 3.5 feet at some time from October through May; Nester—perched at a depth of 2.5 to 3.5 feet at some time from November through May

*Surface runoff:* Morganlake—slow; Nester—medium

*Flooding:* None

*Hazard of water erosion:* Moderate

*Hazard of soil blowing:* Morganlake—severe; Nester—moderate

*Shrink-swell potential:* Moderate

*Potential for frost action:* Morganlake—low; Nester—moderate

### Composition

Morganlake soil and similar soils: 45 to 55 percent

Nester soil and similar soils: 35 to 45 percent

Contrasting inclusions: 5 to 20 percent

### Inclusions

*Contrasting inclusions:*

- The poorly drained Sims soils
- The somewhat poorly drained Kokosing soils

*Similar inclusions:*

- Soils in which the depth to a loamy substratum is more than 40 inches

### Use and Management

*Dominant land use:* Woodland

*Other uses:* Cropland, pasture

#### Cropland

*Major management concerns:* Morganlake—soil blowing, water erosion, seasonal droughtiness; Nester—soil blowing, water erosion, soil compaction, tillage in the surface layer, restricted permeability, seasonal droughtiness

*Management considerations:*

- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. Maintaining a permanent plant cover also helps to control soil blowing.
- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tillage.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- In areas of the Nester soil, a system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- In areas of the Nester soil, most adapted crops can be grown if an adequate drainage system is installed.
- Because of the restricted permeability, subsurface drains in areas of the Nester soil should be narrowly spaced.

#### Pasture

*Major management concerns:* Morganlake—seasonal droughtiness; Nester—compaction

*Management considerations:*

- In areas of the Morganlake soil, proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- In areas of the Nester soil, proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.

**Woodland**

*Major management concerns:* Morganlake—equipment limitations, plant competition, seedling mortality, seasonal droughtiness; Nester—equipment limitations, plant competition

*Management considerations:*

- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Because loose sand in areas of the Morganlake soil can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- In areas of the Morganlake soil, planting when the soil is moist can reduce the seedling mortality rate. Planting special nursery stock or containerized seedlings or planting seedlings that can withstand droughty conditions can also reduce the seedling mortality rate. Replanting is needed in some areas.
- In areas of the Nester soil, skidders should not be used during wet periods, when ruts form easily.

**Building sites**

*Major management concerns:* Morganlake—shrink-swell, slope, seasonal wetness, cutbanks caving; Nester—shrink-swell, slope, seasonal wetness

*Management considerations:*

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Because cutbanks in areas of the Morganlake soil are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

**Septic tank absorption fields**

*Major management concerns:* Morganlake—restricted permeability, slope, seasonal wetness, rapid

permeability; Nester—restricted permeability, slope, seasonal wetness

*Management considerations:*

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- The poor filtering capacity of the Morganlake soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

**Interpretive Groups**

*Land capability classification:* IIIs

*Woodland ordination symbol:* Morganlake—6S;  
Nester—3L

*Michigan soil management group:* Morganlake—4/2a;  
Nester—1.5a

**442D—Menominee-Curtisville complex,  
12 to 18 percent slopes****Setting**

*Landform:* Till plains and moraines

*Shape of areas:* Irregular

*Size of areas:* 25 to 150 acres

**Typical Profile****Menominee**

*Surface layer:*

0 to 4 inches—very dark grayish brown sand

*Subsurface layer:*

4 to 7 inches—grayish brown sand

*Subsoil:*

7 to 18 inches—dark brown, very friable sand

18 to 23 inches—dark yellowish brown, very friable sand

23 to 39 inches—brown, firm clay loam and light brownish gray sandy loam

39 to 59 inches—reddish brown, firm clay loam

*Substratum:*

59 to 80 inches—brown loam

**Curtisville**

*Surface layer:*

0 to 5 inches—very dark grayish brown sandy loam

**Subsoil:**

- 5 to 10 inches—light brownish gray, friable sandy loam and dark yellowish brown sandy loam
- 10 to 16 inches—brown, firm clay loam and brown sandy loam
- 16 to 29 inches—dark brown, firm clay

**Substratum:**

- 29 to 47 inches—reddish brown clay loam
- 47 to 80 inches—brown clay loam

**Soil Properties and Qualities**

**Permeability:** Menominee—rapid in the sandy part and moderately slow in the loamy part; Curtisville—slow

**Available water capacity:** Moderate

**Drainage class:** Well drained

**Seasonal high water table:** At a depth of more than 6 feet

**Surface runoff:** Menominee—medium; Curtisville—rapid

**Flooding:** None

**Hazard of water erosion:** Severe

**Hazard of soil blowing:** Menominee—severe; Curtisville—moderate

**Shrink-swell potential:** Moderate

**Potential for frost action:** Menominee—low; Curtisville—moderate

**Composition**

Menominee soil and similar soils: 45 to 55 percent

Curtisville soil and similar soils: 35 to 45 percent

Contrasting inclusions: 5 to 20 percent

**Inclusions****Contrasting inclusions:**

- The somewhat poorly drained Kawkawlin and Kokosing soils

**Similar inclusions:**

- Soils in which the depth to loam till is more than 40 inches
- Soils that have a surface layer of clay loam

**Use and Management**

**Dominant land use:** Woodland

**Woodland**

**Major management concerns:** Menominee—equipment limitations, plant competition, seedling mortality, seasonal droughtiness; Curtisville—equipment limitations, plant competition, slope

**Management considerations:**

- The grade should be kept as low as possible in areas of the Curtisville soil.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because loose sand in areas of the Menominee soil can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the Menominee soil is moist can reduce the seedling mortality rate.

**Building sites**

**Major management concerns:** Menominee—slope, cutbanks caving; Curtisville—slope, shrink-swell

**Management considerations:**

- Because of the slope, these soils are poorly suited to building site development unless extensive land shaping is feasible.
- Because cutbanks in areas of the Menominee soil are not stable and are subject to caving, trench walls should be reinforced.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling of the Curtisville soil.

**Septic tank absorption fields**

**Major management concerns:** Menominee—slope, restricted permeability, rapid permeability; Curtisville—slope, restricted permeability

**Management considerations:**

- The poor filtering capacity of the Menominee soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

**Interpretive Groups**

**Land capability classification:** VIIe

**Woodland ordination symbol:** Menominee—6S; Curtisville—3L

**Michigan soil management group:** Menominee—4/2a; Curtisville—1.5a

## 442E—Menominee-Curtisville complex, 18 to 35 percent slopes

### Setting

*Landform:* Till plains and moraines

*Shape of areas:* Irregular

*Size of areas:* 25 to 250 acres

### Typical Profile

#### Menominee

*Surface layer:*

0 to 4 inches—very dark grayish brown sand

*Subsurface layer:*

4 to 7 inches—grayish brown sand

*Subsoil:*

7 to 18 inches—dark brown, very friable sand

18 to 23 inches—dark yellowish brown, very friable sand

23 to 39 inches—brown, firm clay loam and light brownish gray sandy loam

39 to 59 inches—reddish brown, firm clay loam

*Substratum:*

59 to 80 inches—brown loam

#### Curtisville

*Surface layer:*

0 to 5 inches—very dark grayish brown sandy loam

*Subsoil:*

5 to 10 inches—light brownish gray, friable sandy loam and dark yellowish brown sandy loam

10 to 16 inches—brown, firm clay loam and brown sandy loam

16 to 29 inches—dark brown, firm clay

*Substratum:*

29 to 80 inches—reddish brown and brown clay loam

### Soil Properties and Qualities

*Permeability:* Menominee—rapid in the sandy part and moderately slow in the loamy part; Curtisville—slow

*Available water capacity:* Moderate

*Drainage class:* Well drained

*Seasonal high water table:* At a depth of more than 6 feet

*Surface runoff:* Menominee—rapid; Curtisville—very rapid

*Flooding:* None

*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Menominee—severe; Curtisville—moderate

*Shrink-swell potential:* Moderate

*Potential for frost action:* Menominee—low; Curtisville—moderate

### Composition

Menominee soil and similar soils: 45 to 55 percent

Curtisville soil and similar soils: 35 to 45 percent

Contrasting inclusions: 5 to 20 percent

### Inclusions

*Contrasting inclusions:*

- The somewhat poorly drained Kawkawlin and Kokosing soils

*Similar inclusions:*

- Soils in which the depth to loam till is more than 40 inches
- Soils that have a surface layer of clay loam

### Use and Management

*Dominant land use:* Woodland

#### Woodland

*Major management concerns:* Menominee—equipment limitations, erosion hazard, plant competition, slope, seedling mortality, seasonal droughtiness; Curtisville—equipment limitations, erosion hazard, plant competition, slope

*Management considerations:*

- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- The grade should be kept as low as possible.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because loose sand in areas of the Menominee soil can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the Menominee soil is moist can reduce the seedling mortality rate.

#### Building sites

*Major management concerns:* Slope

*Management considerations:*

- Because of the slope, these soils are generally unsuited to building site development.

**Septic tank absorption fields***Major management concerns:* Slope*Management considerations:*

- Because of the slope, these soils are generally unsuited to septic tank absorption fields.

**Interpretive Groups***Land capability classification:* VIIe*Woodland ordination symbol:* Menominee—6R;

Curtisville—3R

*Michigan soil management group:* Menominee—4/2a;

Curtisville—1.5a

**443B—Kawkawlin-Allendale-Aquepts complex, 0 to 4 percent slopes****Setting***Landform:* Till plains and moraines*Slope range:* Kawkawlin—0 to 4 percent; Allendale—0 to 3 percent; Aquepts—0 to 2 percent*Shape of areas:* Irregular*Size of areas:* 25 to 200 acres**Typical Profile****Kawkawlin***Surface layer:*

0 to 6 inches—very dark grayish brown sandy loam

*Subsurface layer:*

6 to 8 inches—light brownish gray, mottled sandy loam

*Subsoil:*

8 to 13 inches—yellowish brown, mottled, friable sandy loam

13 to 18 inches—light brownish gray sandy loam and dark brown, mottled, friable clay loam

18 to 37 inches—light brown, mottled, friable clay loam

*Substratum:*

37 to 60 inches—brown sandy clay loam

60 to 80 inches—brown, mottled sandy clay loam

**Allendale***Surface layer:*

0 to 6 inches—very dark brown loamy sand

*Subsurface layer:*

6 to 8 inches—light brownish gray, mottled sand

*Subsoil:*

8 to 11 inches—dark brown, mottled, friable sand

11 to 18 inches—strong brown, mottled, friable sand

18 to 32 inches—pale brown, mottled, loose sand

32 to 36 inches—reddish brown, mottled, very firm clay

*Substratum*

36 to 43 inches—brown, mottled clay

43 to 80 inches—weak red, mottled clay

**Aquepts***Surface layer:*

0 to 8 inches—black sandy loam

*Subsoil:*

8 to 30 inches—brownish gray, friable clay loam

*Substratum:*

30 to 80 inches—light brownish gray clay

**Soil Properties and Qualities***Permeability:* Kawkawlin—slow; Allendale—rapid in the sandy part and very slow in the clayey part;

Aquepts—moderate

*Available water capacity:* Kawkawlin—high; Allendale and Aquepts—moderate*Drainage class:* Kawkawlin and Allendale—somewhat poorly drained; Aquepts—very poorly drained*Seasonal high water table:* Kawkawlin and Allendale—perched at a depth of 0.5 foot to 1.5 feet at some time from October through May; Aquepts—

perched at the surface to 1 foot above the surface at some time from January through December

*Surface runoff:* Kawkawlin—medium; Allendale—very slow; Aquepts—ponded*Flooding:* None*Hazard of water erosion:* Kawkawlin—moderate;

Allendale and Aquepts—slight

*Hazard of soil blowing:* Moderate*Shrink-swell potential:* Kawkawlin—moderate;

Allendale—high; Aquepts—moderate

*Potential for frost action:* Kawkawlin—high; Allendale—moderate; Aquepts—high**Composition**

Kawkawlin soil and similar soils: 30 to 40 percent

Allendale soil and similar soils: 30 to 40 percent

Aquepts and similar soils: 20 to 30 percent

Contrasting inclusions: 10 to 15 percent

**Inclusions***Contrasting inclusions:*

- The poorly drained Sims soils

- The very poorly drained, sandy over clayey Wakeley soils

*Similar inclusions:*

- Soils that have a surface layer of loam
- Soils in which the depth to a loamy substratum is more than 40 inches

### **Use and Management**

*Dominant land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, windthrow hazard, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Trees that can withstand seasonal wetness should be selected for planting on the Kawkawlin and Allendale soils.
- Special site preparation, such as bedding before planting, can reduce the seedling mortality rate in areas of the Kawkawlin and Allendale soils.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Aquepts.
- Carefully managed reforestation helps to control undesirable understory plants.

#### **Building sites**

*Major management concerns:* Kawkawlin—seasonal wetness, shrink-swell; Allendale—seasonal wetness, shrink-swell, cutbanks caving; Aquepts—ponding

*Management considerations:*

- Buildings in areas of the Kawkawlin and Allendale soils can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Because of ponding, the Aquepts are generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Kawkawlin—seasonal wetness, restricted permeability; Allendale—

seasonal wetness, rapid permeability, restricted permeability; Aquepts—ponding

*Management considerations:*

- In areas of the Kawkawlin and Allendale soils, filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability in the Kawkawlin soil and in the lower part of the Allendale soil.
- The poor filtering capacity of the upper part of the Allendale soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Because of ponding, the Aquepts are generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* IIIw

*Woodland ordination symbol:* Kawkawlin—3W; Allendale—4W; Aquepts—none assigned

*Michigan soil management group:* Kawkawlin—1.5b; Allendale—4/1b; Aquepts—none assigned

## **444B—Kawkawlin sandy loam, 0 to 4 percent slopes**

### **Setting**

*Landform:* Till plains and moraines

*Shape of areas:* Irregular

*Size of areas:* 5 to 150 acres

### **Typical Profile**

*Surface layer:*

0 to 6 inches—very dark grayish brown sandy loam

*Subsurface layer:*

6 to 8 inches—light brownish gray, mottled sandy loam

*Subsoil:*

8 to 13 inches—yellowish brown, mottled, friable sandy loam

13 to 18 inches—light brownish gray sandy loam and dark brown, mottled, friable clay loam

18 to 37 inches—light brown, mottled, friable clay loam

*Substratum:*

37 to 60 inches—brown sandy clay loam

60 to 80 inches—brown, mottled sandy clay loam

### **Soil Properties and Qualities**

*Permeability:* Slow

*Available water capacity:* High  
*Drainage class:* Somewhat poorly drained  
*Seasonal high water table:* Perched at a depth of 0.5 foot to 1.5 feet at some time from October through May  
*Surface runoff:* Medium  
*Flooding:* None  
*Hazard of water erosion:* Moderate  
*Hazard of soil blowing:* Moderate  
*Shrink-swell potential:* Moderate  
*Potential for frost action:* High

### **Composition**

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

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Kokosing soils, which have more sand in the surface layer and the upper part of the subsoil than the Kawkawlin soil
- The poorly drained Sims soils

*Similar inclusions:*

- Soils that have less clay in the subsoil
- Soils that have a surface layer of clay loam

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

#### **Cropland**

*Major management concerns:* Water erosion, seasonal wetness, tilth in the surface layer, nutrient and pesticide loss

*Management considerations:*

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to control runoff and water erosion.
- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Shallow surface ditches help to remove surface water after heavy rains.
- Returning crop residue to the soil, adding other organic material, and including grasses and legumes in the cropping sequence improve soil structure, water infiltration, and permeability.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.
- Conservation tillage systems, contour farming, cover

crops, and sod-based rotations can minimize the detachment and loss of nutrients associated with sediment and thus help to prevent the loss of solid-phase nitrogen and phosphorus.

#### **Pasture**

*Major management concerns:* Seasonal wetness, overgrazing, compaction

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants.

#### **Woodland**

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Trees that can withstand seasonal wetness should be selected for planting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.

#### **Building sites**

*Major management concerns:* Seasonal wetness, shrink-swell

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Properly designing and strengthening footings and

foundations can help to prevent the structural damage caused by shrinking and swelling.

### **Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, restricted permeability

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drainfields helps to overcome the restricted permeability.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### **Interpretive Groups**

*Land capability classification:* IIe

*Woodland ordination symbol:* 3W

*Michigan soil management group:* 1.5b

## **445A—Corsair very fine sandy loam, 0 to 3 percent slopes**

### **Setting**

*Landform:* Lake plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 25 acres

### **Typical Profile**

*Surface layer:*

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

*Subsurface layer:*

8 to 10 inches—pale brown fine sand and yellowish brown loamy fine sand

*Subsoil:*

10 to 15 inches—dark yellowish brown, friable fine sandy loam

*Substratum:*

15 to 80 inches—yellowish brown, mottled, stratified very fine sand, sand, and silt

### **Soil Properties and Qualities**

*Permeability:* Moderate

*Available water capacity:* Moderate

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Perched at a depth of 1 to 2 feet at some time from October through May

*Surface runoff:* Slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Moderate

*Shrink-swell potential:* Low

*Potential for frost action:* Moderate

### **Composition**

Corsair soil and similar soils: 85 to 90 percent

Contrasting inclusions: 10 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Ingalls soils, which contain more sand in the surface layer and subsoil than the Corsair soil
- The very poorly drained Deford soils

*Similar inclusions:*

- Soils that have less stratification in the substratum
- Soils that have more clay in the subsoil

### **Use and Management**

*Dominant land use:* Cropland

*Other uses:* Pasture, woodland

#### **Cropland**

*Major management concerns:* Seasonal wetness, soil blowing, nutrient and pesticide loss

*Management considerations:*

- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.
- Timing fertilizer applications to meet crop nutrient needs, using split fertilizer applications, and applying fertilizer in bands may reduce the risk of nutrient leaching.
- Most adapted crops can be grown if an adequate drainage system is installed.
- Subsurface drains can reduce the wetness if a suitable outlet is available.

#### **Pasture**

*Major management concerns:* Seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

#### **Woodland**

*Major management concerns:* Equipment limitations, windthrow hazard, plant competition, seasonal wetness

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.

- Trees that can withstand seasonal wetness should be selected for planting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

### **Building sites**

*Major management concerns:* Seasonal wetness, cutbanks caving

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

### **Septic tank absorption fields**

*Major management concerns:* Seasonal wetness

*Management considerations:*

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- A subsurface drainage system helps to lower the water table.

### **Interpretive Groups**

*Land capability classification:* Vw

*Woodland ordination symbol:* 2W

*Michigan soil management group:* 3b-s

## **446B—Wurtsmith-Meehan-Urban land complex, 0 to 6 percent slopes**

### **Setting**

*Landform:* Beach ridges on lake plains

*Slope range:* Wurtsmith—0 to 6 percent; Meehan and Urban land—0 to 3 percent

*Shape of areas:* Irregular

*Size of areas:* 50 to 300 acres

### **Typical Profile**

#### **Wurtsmith**

*Surface layer:*

0 to 1 inch—black, partially decomposed leaf litter

*Subsurface layer:*

1 to 4 inches—grayish brown sand

*Subsoil:*

4 to 14 inches—yellowish brown, very friable sand

14 to 24 inches—brownish yellow, mottled, very friable sand

*Substratum:*

24 to 80 inches—pale brown and brown sand

#### **Meehan**

*Surface layer:*

0 to 2 inches—very dark gray sand

*Subsurface layer:*

2 to 9 inches—pale brown sand

*Subsoil:*

9 to 43 inches—brown, yellowish brown, and light yellowish brown, mottled, very friable sand

*Substratum:*

43 to 80 inches—brown sand

### **Soil Properties and Qualities**

*Permeability:* Rapid

*Available water capacity:* Low

*Drainage class:* Wurtsmith—moderately well drained; Meehan—somewhat poorly drained

*Seasonal high water table:* Wurtsmith—apparent, at a depth of 2.0 to 3.5 feet at some time from November through May; Meehan—apparent, at a depth of 1 to 3 feet at some time from October through June

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Low

*Potential for frost action:* Wurtsmith—low; Meehan—moderate

### **Composition**

Wurtsmith soil and similar soils: 40 to 50 percent

Meehan soil and similar soils: 30 to 40 percent

Urban land: 20 to 30 percent

Contrasting inclusions: 5 to 15 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Deford soils
- The excessively drained Grayling soils

*Similar inclusions:*

- Soils that have a darker subsoil

### **Use and Management**

*Dominant land use:* Wurtsmith and Meehan—gardens, lawns, building sites, idle land; Urban land—streets, parking lots, sites for buildings and other structures

#### **Gardens, lawns, and environmental plantings**

*Major management concerns:* Low available water capacity, soil blowing

##### *Management considerations*

- Irrigation may be needed to maintain lawns and gardens.
- Perennial plants that can withstand droughtiness should be selected for planting.
- Maintaining a good plant cover and mulching can help to control soil blowing.

#### **Building sites**

*Major management concerns:* Wurtsmith and Meehan—cutbanks caving, seasonal wetness

##### *Management considerations:*

- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.

#### **Septic tank absorption fields**

*Major management concerns:* Wurtsmith and Meehan—rapid permeability, seasonal wetness

##### *Management considerations:*

- The poor filtering capacity of the Wurtsmith and Meehan soils can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Sanitary facilities should be connected to public sewers and sewage treatment facilities.
- A subsurface drainage system helps to lower the water table.

### **Interpretive Groups**

*Land capability classification:* Wurtsmith and Meehan—IVs

*Woodland ordination symbol:* Wurtsmith—6S; Meehan—5W

*Michigan soil management group:* Wurtsmith—5a; Meehan—5b

### **447A—Whittemore sand, 0 to 3 percent slopes**

#### **Setting**

*Landform:* Lake plains

*Shape of areas:* Irregular

*Size of areas:* 5 to 50 acres

#### **Typical Profile**

*Surface layer:*

0 to 9 inches—very dark gray sand

*Subsurface layer:*

9 to 12 inches—light grayish brown and light gray sand

*Subsoil:*

12 to 17 inches—dark reddish brown, mottled, strongly cemented, firm sand

17 to 35 inches—yellowish brown and light yellowish brown, mottled, loose sand

35 to 44 inches—light reddish brown, mottled, firm silty clay

*Substratum:*

44 to 80 inches—reddish brown, mottled silty clay

#### **Soil Properties and Qualities**

*Permeability:* Moderately rapid in the sandy part and very slow in the clayey part

*Available water capacity:* Low

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Perched at a depth of 0.5 foot to 1.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* High

*Potential for frost action:* Moderate

#### **Composition**

Whittemore soil and similar soils: 85 to 90 percent

Contrasting inclusions: 10 to 15 percent

#### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained, clayey Algonquin soils
- The very poorly drained Wakeley soils

*Similar inclusions:*

- Soils that have less cementation in the subsoil
- Soils that have less clay in the substratum

## Use and Management

*Dominant land use:* Woodland

*Other uses:* Pasture

### Pasture

*Major management concerns:* Seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

### Woodland

*Major management concerns:* Seasonal wetness, equipment limitations, plant competition, seedling mortality, windthrow hazard

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Trees that can withstand seasonal wetness should be selected for planting.
- Carefully managed reforestation helps to control undesirable understory plants.
- Special harvest methods may be needed to control undesirable plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

### Building sites

*Major management concerns:* Seasonal wetness, cutbanks caving, shrink-swell

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

### Septic tank absorption fields

*Major management concerns:* Seasonal wetness, rapid permeability, restricted permeability

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

## Interpretive Groups

*Land capability classification:* IIIw

*Woodland ordination symbol:* 4W

*Michigan soil management group:* 5/2b

### 448A—Meehan-Tawas complex, 0 to 3 percent slopes

#### Setting

*Landform:* Beach ridges on lake plains

*Slope range:* Meehan—0 to 3 percent; Tawas—0 to 2 percent

*Shape of areas:* Linear

*Size of areas:* 50 to 300 acres

#### Typical Profile

#### Meehan

*Surface layer:*

0 to 2 inches—very dark gray sand

*Subsurface layer:*

2 to 9 inches—pale brown sand

*Subsoil:*

9 to 12 inches—brown, mottled, very friable sand

12 to 21 inches—yellowish brown, mottled, very friable sand

21 to 43 inches—light yellowish brown, mottled, loose sand

*Substratum:*

43 to 80 inches—brown sand

#### Tawas

*Surface layer:*

0 to 12 inches—black muck

*Subsoil:*

12 to 24 inches—black, very friable muck

*Substratum:*

24 to 80 inches—light brownish gray sand

### **Soil Properties and Qualities**

*Permeability:* Meehan—rapid; Tawas—moderately slow to moderately rapid in the mucky part and rapid in the sandy part

*Available water capacity:* Meehan—low; Tawas—high

*Drainage class:* Meehan—somewhat poorly drained; Tawas—very poorly drained

*Seasonal high water table:* Meehan—apparent, at a depth of 1 to 3 feet at some time from October through June; Tawas—apparent, 1 foot above to 1 foot below the surface at some time from October through May

*Surface runoff:* Meehan—very slow; Tawas—very slow or ponded

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Meehan—severe; Tawas—moderate

*Shrink-swell potential:* Low

*Potential for frost action:* Meehan—moderate; Tawas—high

### **Composition**

Meehan soil and similar soils: 50 to 60 percent

Tawas soils and similar soils: 30 to 40 percent

Contrasting inclusions: 15 to 25 percent

### **Inclusions**

*Contrasting inclusions:*

- The very poorly drained Deford soils, which have less than 8 inches of muck at the surface
- The excessively drained Grayling soils

*Similar inclusions:*

- Soils that have a darker subsoil

### **Use and Management**

*Dominant land use:* Woodland

#### **Woodland**

*Major management concerns:* Equipment limitations, seedling mortality, plant competition, seasonal wetness, windthrow hazard

*Management considerations:*

- Because loose sand in areas of the Meehan soil can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Because of wetness and low strength, special harvesting equipment is needed in areas of the Tawas soil. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- In areas of the Meehan soil, the seasonal high water table restricts the use of equipment to midsummer,

when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.

- Trees that can withstand seasonal wetness should be selected for planting on the Meehan soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Carefully managed reforestation helps to control undesirable understory plants in areas of the Meehan soil.
- Special harvest methods may be needed to control undesirable plants in areas of the Meehan soil.
- In areas of the Tawas soil, selective cutting or cutting in strips and leaving desirable seed trees along the edge of the openings are beneficial for natural regeneration.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Tawas soil.

#### **Building sites**

*Major management concerns:* Meehan—cutbanks caving, seasonal wetness; Tawas—ponding

*Management considerations:*

- Because cutbanks in areas of the Meehan soil are not stable and are subject to caving, trench walls should be reinforced.
- In areas of the Meehan soil, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness in areas of the Meehan soil can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Because of ponding, the Tawas soil is generally unsuited to building site development.

#### **Septic tank absorption fields**

*Major management concerns:* Meehan—rapid permeability, seasonal wetness; Tawas—ponding

*Management considerations:*

- The poor filtering capacity of the Meehan soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- In areas of the Meehan soil, filling or mounding with suitable material helps to raise the absorption field above the water table.
- Because of ponding, the Tawas soil is generally unsuited to septic tank absorption fields.

### **Interpretive Groups**

*Land capability classification:* IVw

*Woodland ordination symbol:* Meehan—5W; Tawas—5W

*Michigan soil management group:* Meehan—5b; Tawas—M/4c

### **449A—Kokosing sand, 0 to 3 percent slopes**

#### **Setting**

*Landform:* Till plains and moraines

*Shape of areas:* Irregular

*Size of areas:* 5 to 50 acres

#### **Typical Profile**

*Surface layer:*

0 to 9 inches—very dark grayish brown sand

*Subsoil:*

9 to 27 inches—dark yellowish brown and yellowish brown, mottled, very friable sand

27 to 32 inches—pale brown, friable loamy sand and brown, mottled, friable loam

32 to 38 inches—reddish brown, friable loam and light brownish gray, mottled, friable sandy loam

38 to 53 inches—reddish brown, mottled, friable loam

*Substratum:*

53 to 80 inches—reddish brown loam

#### **Soil Properties and Qualities**

*Permeability:* Rapid in the sandy part and moderately slow in the loamy part

*Available water capacity:* Moderate

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* Perched at a depth of 0.5 foot to 2.5 feet at some time from October through May

*Surface runoff:* Very slow

*Flooding:* None

*Hazard of water erosion:* Slight

*Hazard of soil blowing:* Severe

*Shrink-swell potential:* Moderate

*Potential for frost action:* Moderate

#### **Composition**

Kokosing soil and similar soils: 85 to 90 percent

Contrasting inclusions: 10 to 15 percent

#### **Inclusions**

*Contrasting inclusions:*

- The somewhat poorly drained Kawkawlin soils,

which contain less clay in the surface layer and the upper part of the subsoil than the Kokosing soil

- The very poorly drained Wakeley soils

*Similar inclusions:*

- Soils that have less clay in the substratum

### **Use and Management**

*Dominant land use:* Woodland

*Other uses:* Cropland, pasture

#### **Cropland**

*Major management concerns:* Seasonal wetness, soil blowing, nutrient and pesticide loss

*Management considerations:*

- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.
- Timing fertilizer applications to meet crop nutrient needs, using split fertilizer applications, and applying fertilizer in bands may reduce the risk of nutrient leaching.
- The nutrients in manure and fertilizer applications should not exceed the requirements of the plants.
- Most adapted crops can be grown if an adequate drainage system is installed.
- Subsurface drains can reduce the wetness if a suitable outlet is available.

#### **Pasture**

*Major management concerns:* Seasonal wetness

*Management considerations:*

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Hay and pasture plants that can withstand periodic inundation and seasonal wetness should be seeded.

#### **Woodland**

*Major management concerns:* Seasonal wetness, equipment limitations, plant competition, seedling mortality, windthrow hazard

*Management considerations:*

- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Trees that can withstand seasonal wetness should be selected for planting.
- Carefully managed reforestation helps to control undesirable understory plants.

- Special harvest methods may be needed to control undesirable plants.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.

### **Building sites**

*Major management concerns:* Seasonal wetness, cutbanks caving

*Management considerations:*

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by installing a drainage system around structures with basements and crawl spaces.
- Because cutbanks are not stable and are subject to caving, trench walls should be reinforced.

### **Septic tank absorption fields**

*Major management concerns:* Seasonal wetness, rapid permeability, restricted permeability

*Management considerations:*

- The poor filtering capacity of this soil can result in the pollution of ground water.
- Large lots, an absorption system of shallow trenches with shrubbery planted around the perimeter of the system, and low, uniform application rates help to prevent the pollution of ground water.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

### ***Interpretive Groups***

*Land capability classification:* IIIw

*Woodland ordination symbol:* 2W

*Michigan soil management group:* 4/2b