

USDA United States
Department of
Agriculture

In cooperation with the
Minnesota Agricultural
Experiment Station

Soil Survey of Marshall County, Minnesota

SOIL SURVEY
Natural
Resources
Conservation
Service

The logo for the Soil Survey Centennial, featuring a circular emblem with a green tree, a yellow sun, and a red field, with the text "SOIL SURVEY" above and "CENTENNIAL" below.

Part I



This page intentionally left blank.

How to Use This Soil Survey

This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the general soil map units, detailed soil map units, and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. This part may be updated as further information about soil management becomes available. Part III includes the maps.

On the **general soil map**, the survey area is 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** in Part I of this survey for a general description of the soils in your area.

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 **Index to Map Units** in Part I of this survey, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** in Part II shows which table has data on a specific land use for each detailed soil map unit. See the **Contents** in Part I and Part II for other sections of this publication that may address your specific needs.

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

Major fieldwork for this soil survey was completed in November 1992. Soil names and descriptions were approved in September 1994. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. This survey was made cooperatively by the Natural Resources Conservation Service and the Minnesota Agricultural Experiment Station. Assistance was provided by the Agriculture Extension Service, Minnesota Department of Natural Resources, and the Board of Water and Soil Resources. The survey was partially funded by the Legislative Commission for Minnesota Resources and by Marshall County. It is part of the technical assistance furnished to the Marshall County Soil and Water Conservation District.

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

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: Several conservation practices are visible on this farmstead east of Argyle in Marshall County. Field windbreaks and conservation tillage reduce the hazard of soil blowing in an area of the Wheatville-Glyndon association. Crop rotations help to control erosion and maintain soil fertility.

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

How to Use This Soil Survey	3	8. Grimstad-Strathcona-Vallers Association	22
Index to Series	6	9. Percy-Strathcona-Mavie Association	22
Index to Map Units	7	10. Roliss-Vallers-Mavie Association	23
Foreword	9	11. Karlstad-Deerwood-Syrene Association ...	24
How This Survey Was Made	11	12. Redby-Northwood-Cormant Association ...	24
General Nature of the Survey Area	12	13. Smiley-Kratka-Reiner Association	25
Tables:		14. Clearwater-Wyandotte Association	26
Temperature and Precipitation	15	15. Cathro-Dora-Wildwood Association	28
Freeze Dates in Spring and Fall	16	Formation and Classification of the Soils	29
Growing Season	16	Tables:	
General Soil Map Units	17	Classification of the Soils	32
1. Wahpeton-Fargo Association	17	Acreage and Proportionate Extent of	
2. Colvin-Bearden Association	17	the Soils	34
3. Northcote-Eaglepoint Association	18	Soil Series and Detailed Soil Map Units	37
4. Fargo-Colvin-Hegne Association	19	References	135
5. Wheatville-Glyndon Association	19	Glossary	137
6. Ulen-Flaming Association	19		
7. Sandberg-Strathcona-Syrene Association	20		

Issued 2000

Index to Series

Augsburg series	38	Linveldt series	84
Bearden series	39	Lupton series	85
Berner series	41	Markey series	86
Boash series	43	Marquette series	90
Borup series	44	Mavie series	91
Cathro series	45	Nereson series	92
Clearriver series	46	Newfolden series	94
Clearwater series	47	Northcote series	95
Colvin series	50	Northwood series	96
Corliss series	51	Pelan series	97
Cormant series	52	Percy series	99
Deerwood series	53	Poppleton series	101
Dora series	54	Radium series	102
Eaglepoint series	55	Redby series	103
Eckvoll series	57	Reiner series	104
Enstrom series	58	Reis series	106
Espelie series	59	Rifle series	106
Fargo series	60	Roliss series	107
Flaming series	62	Rosewood series	109
Foldahl series	63	Rushlake series	112
Foxhome series	64	Sahkahtay series	113
Garnes series	65	Sandberg series	114
Glyndon series	66	Seelyeville series	115
Grimstad series	68	Skagen series	116
Grygla series	69	Smiley series	118
Hamar series	70	Strandquist series	119
Hamerly series	71	Strathcona series	120
Hamre series	72	Syrene series	122
Hangaard series	73	Tacoosh series	123
Haug series	74	Thiefriver series	124
Hegne series	76	Ulen series	125
Hilaire series	77	Vallers series	127
Huot series	78	Wahpeton series	128
Karlstad series	79	Wheatville series	129
Kittson series	80	Wildwood series	130
Kratka series	81	Wyandotte series	132
Lamoure series	82		

Index to Map Units

47—Colvin silty clay loam	50	514—Tacoosh muck	124
57A—Fargo silty clay, 0 to 2 percent slopes	61	540—Seelyeville muck	115
58—Kittson loam	81	541—Rifle mucky peat	107
59—Grimstad fine sandy loam	68	543—Markey muck	86
65—Foxhome sandy loam	65	544—Cathro muck	45
66—Flaming loamy fine sand	62	546—Lupton muck	85
67A—Bearden silt loam, 0 to 2 percent slopes	40	547—Deerwood muck	54
67B—Bearden silt loam, 2 to 6 percent slopes	40	550—Dora muck	55
77—Garnes fine sandy loam	66	563—Northwood muck	97
93A—Bearden silty clay loam, 0 to 2 percent slopes	40	565—Eckvoll loamy fine sand	58
111—Hangaard sandy loam	74	582—Roliss loam	108
116—Redby loamy fine sand	104	583—Nereson fine sandy loam	93
117—Cormant loamy fine sand	53	630—Wildwood muck	131
145—Enstrom loamy fine sand	59	641—Clearwater clay	48
148—Poppleton fine sand	102	642—Clearwater loam	48
157A—Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	128	643—Huot fine sandy loam	79
157B—Wahpeton silty clay, 2 to 6 percent slopes, occasionally flooded	128	644—Boash clay loam	43
184A—Hamerly loam, 0 to 3 percent slopes	71	645—Espelie fine sandy loam	60
187—Haug muck	75	647—Hilaire loamy fine sand	77
205—Karlstad loamy sand	80	648—Newfolden loam	94
236—Vallers loam	127	649—Reiner loamy fine sand	105
242B—Marquette loamy sand, 1 to 8 percent slopes	91	650—Reiner fine sandy loam	105
258B—Sandberg loamy sand, 1 to 6 percent slopes	114	651—Thiefriever fine sandy loam	125
280—Pelan sandy loam	98	652—Wyandotte clay loam	132
372—Hamar loamy fine sand	70	653—Smiley mucky loam, depressional	119
379—Percy loam, very cobbly	99	708—Rushlake loamy sand	112
383—Percy loam	100	712—Rosewood fine sandy loam	110
384—Percy mucky loam, depressional	100	713—Linvelde fine sandy loam	84
387—Roliss loam, depressional	108	721B—Corliss loamy sand, 1 to 6 percent slopes	52
412—Mavie fine sandy loam	92	765—Smiley loam	119
418—Lamoure silty clay loam, occasionally flooded	83	794—Clearriver loamy fine sand	47
426—Foldahl loamy fine sand	64	935—Hegne-Fargo complex	76
429A—Northcote clay, 0 to 2 percent slopes	96	936—Clearwater-Reis complex	49
432—Strandquist loam	120	937—Eaglepoint-Northcote complex	56
435—Syrene sandy loam	123	972—Roliss-Vallers complex	109
439—Strathcona fine sandy loam	121	1006—Fluvaquents-Haploborolls complex, 0 to 30 percent slopes, flooded	63
481—Kratka fine sandy loam	82	1030—Pits, gravel-Udipsamments complex	101
482—Grygla loamy fine sand	69	1031—Seelyeville muck, ponded	116
		1143—Bernier-Markey complex	42
		1144—Strathcona and Kratka soils, depressional	122
		1146—Northwood muck, ponded	97

1158—Skagen loam	117	1315A—Wheatville very fine sandy loam, 0 to 2 percent slopes	130
1170—Skagen loam, very cobbly	117	1804—Hamre muck, ponded	73
1187—Dora muck, ponded	55	1807—Cathro muck, ponded	46
1188—Wildwood muck, ponded	131	1808—Markey muck, ponded	90
1189—Clearwater mucky loam, depressional	49	1871—Fargo silty clay, swales	61
1191—Sahkahtay sandy loam	113	1874—Radium loamy sand	103
1264—Ulen loamy fine sand	126	1878—Hamre muck	72
1297—Augsburg very fine sandy loam	39	1882—Rosewood, Strathcona, and Berner soils, seepy	110
1299—Borup very fine sandy loam	44	1963—Bearden-Colvin complex	41
1304A—Glyndon very fine sandy loam, 0 to 2 percent slopes	67	1964—Colvin-Fargo complex	51
1304B—Glyndon very fine sandy loam, 2 to 6 percent slopes	67	1966—Rosewood-Hamar complex	111

Foreword

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

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

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

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

William Hunt
State Conservationist
Natural Resources Conservation Service

This page intentionally left blank.

Soil Survey of Marshall County, Minnesota

By John Beck and Patricia Wright-Koll, Natural Resources Conservation Service

Fieldwork by John Beck, Patricia Wright-Koll, Kim Steffen, and Steven Wangemann, Natural Resources Conservation Service, and William Gunnerson, Grant Johnson, and Norman Mofjeld, Minnesota Agricultural Experiment Station

Contract mapping by Donald Barron

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Minnesota Agricultural Experiment Station

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 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 slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. 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 or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, soil scientists develop a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientists to predict with a considerable degree of accuracy the

kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate 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 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 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.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

General Nature of the Survey Area

Marshall County is in northwestern Minnesota (fig. 1). Warren is the county seat. The total area of the county is 1,160,100 acres, or about 1,813 square miles. Farming is the principal business enterprise. Small grain, beans, hay, sunflowers, sugar beets,

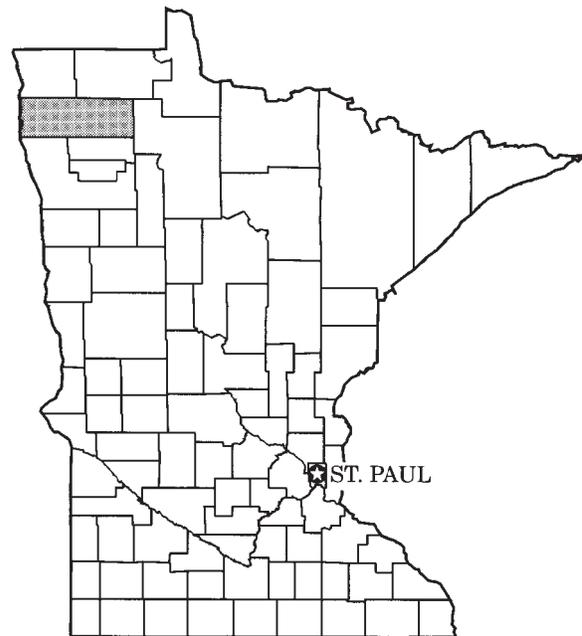


Figure 1.—Location of Marshall County in Minnesota.

potatoes, and soybeans are the main crops. Dairy farming is the main livestock enterprise.

The soils in Marshall County formed on a glacial lake plain (Glacial Lake Agassiz). They are mainly dark and formed under wet prairie grasses and sedges. Forest vegetation encroached into the county from the east. The soils in the north-central and eastern one-third of Marshall County show the influence of forest vegetation on soil profile development.

This soil survey updates the Red River Valley (reconnaissance) soil survey published in 1939 (Nikiforoff, 1939). It provides additional information and has larger maps, which show the soils in greater detail.

History and Development

The Marshall County Historical Society helped prepare this section.

Marshall County was established on February 25, 1879, when the Minnesota Legislature divided Kittson County. The county is named after William Rainy Marshall, who served as Governor of Minnesota from 1866 to 1870. Marshall, a native of Missouri, became a pioneer hardware merchant in the newly organized Minnesota Territory in 1849. He

served in the Civil War and was promoted to brigadier general.

The first permanent settler in the survey area was Michael "Tamarac Mac" McCullough. In 1871, McCullough staked a claim to 160 acres along the Tamarac River near the present town of Stephen.

Agriculture, especially the production of wheat, and sawmills were of paramount importance when the county was established, but the economic base has expanded over the years. Farming is still the major economic factor in the county, but industry and manufacturing are also important.

The population of Marshall County was 12,800 in 1980. It was 10,993 in 1990.

Transportation Facilities and Markets

In the first half of the 19th century, transportation was by way of the Pembina Trail. Oxcarts traveling the Pembina Trail brought trade goods into the county. This trail and the oxcart trade routes formed the basis of the state's first highway system, the Red River Trails.

Today the Soo Line Railroad and the Burlington Northern Railroad cross the county from north to south. The Soo Line also crosses the western two-thirds of the county in an east-west direction.

A network of all-weather roads serves the county. The major roads are State Highways 220, 32, 89, 219, and 1 and U.S. Highways 75 and 59.

Grain is hauled to local elevators and then shipped by rail or trucks to Duluth or Minneapolis. Large quantities of grain may be stored on the farm. Sugar beets are transported by truck to Drayton, North Dakota, or East Grand Forks for processing. Much of the potato crop is marketed locally. Some potatoes are shipped to Minneapolis. Dairy products are marketed locally or in adjacent counties. Slaughter or feeder animals are shipped by truck to West Fargo, to Winger, Minnesota, or to South St. Paul.

Wheat, barley, and oats are the major grain crops. Potatoes and sugar beets are also grown. Potatoes are grown on the coarser textured soils. Sugar beets are grown largely on the medium and fine textured soils in the western part of the county. Soybeans and sunflowers are other important crops. Acreages of these crops fluctuate with current markets. Hay for livestock feed is produced in the eastern two-thirds of the county. Some dairy and livestock operations are throughout the county.

Physiography, Relief, and Drainage

All of Marshall County has been influenced by the waters of Glacial Lake Agassiz. In the western part of the county, where the glacial water was deep, the soils are clayey. In the areas to the east, away from the Red River, progressively coarser particles settled out, grading from clay, silt, very fine sand, fine sand, and sand to gravel. As the water level of the lake receded, a succession of beach ridges formed. These beach ridges range in texture from coarse-silty material on the wide, almost unnoticeable beach ridge at the eastern edge of the Red River Valley to sandy and gravelly material on the prominent ridges in the central and eastern parts of the county. In the eastern part of Marshall County, the water was shallow and covered the area for a relatively short period of time. The deposited lake sediment is very thin over glacial till deposits. The evidence of sorting action by waves is apparent in the concentration of stones and boulders at or near the surface of the soils in the north-central part of the county (Hobbs and Goebel, 1982).

The highest elevation in Marshall County, 1,225 feet above sea level, is on the beach ridges in the northeastern one-third of the county near Thief Lake. The lowest point is 770 feet above sea level in the northwest corner, where the Red River leaves the county. The maximum difference in elevation from the northeast to the northwest is approximately 455 feet. The slope gradient in the western part of the county ranges from 1 to 3 feet per mile (Arndt, 1977).

The drainage of Marshall County can be divided into two main areas—the eastern one-third and the western two-thirds. The eastern section drains to the south. This section is drained in the north by the Moose River, which empties into Thief Lake. The middle part of the eastern section is drained by the Mud River, which empties into Mud Lake. Both Thief Lake and Mud Lake are drained by the Thief River, which flows south into adjoining Pennington County. The Mud and Thief Rivers have been partially diverted and channelized, especially in the area of the Agassiz National Wildlife Refuge. The U.S. Fish and Wildlife Service operates a water management system that benefits the wildlife in the area.

The western two-thirds of Marshall County drains to the west. This section is drained in the north by the Tamarac River. The central part is drained by the Middle River. The southern part is drained by the Snake River, which flows southwest into Polk County for several miles and then north in Marshall County

where it is joined by the Middle River. All of the rivers and tributaries in the western portion empty into the Red River of the North, which flows north along the extreme western edge of the county. Natural creeks and drainageways and an extensive system of legal ditches and agricultural drainage systems remove excess water from farming and residential areas.

Climate

The three tables at the end of this section provide climate data for the survey area as recorded at Argyle in the period 1961 to 1990.

In winter, the average temperature is 5 degrees F and the average daily minimum temperature is -5 degrees. The lowest temperature on record, which occurred at Argyle on January 21, 1954, is -41 degrees. In summer, the average temperature is 66 degrees and the average daily maximum temperature is 79 degrees. The highest temperature, which occurred at Argyle on July 6, 1988, is 105 degrees.

Growing degree days 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 about 18.8 inches. Of this, about 13.8 inches, or 73 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 4.72 inches at Argyle on July 2, 1975. Thunderstorms occur on about 32 days each year, and most occur in July.

The average seasonal snowfall is 38.5 inches. The greatest snow depth at any one time during the period of record was 38 inches. On an average, 12 days per year have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 11.1 inches.

The average relative humidity in midafternoon is about 62 percent. Humidity is higher at night, and the average at dawn is about 81 percent. The sun shines about 67 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 14 miles per hour, in April.

Temperature and Precipitation
(Recorded in the period 1961-90 at Argyle, Minnesota)

Month	Temperature						Precipitation					
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall	
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--			
	°F	°F	°F	°F	°F	Units	In	In	In		In	
January----	11.9	-9.4	1.2	40	-36	0	0.89	0.40	1.37	3	10.6	
February---	18.0	-4.4	6.8	43	-33	0	.59	.28	.87	2	6.3	
March-----	31.9	11.1	21.5	60	-24	7	.95	.30	1.49	3	7.2	
April-----	51.5	28.6	40.0	83	1	122	1.37	.63	2.30	3	1.5	
May-----	67.8	40.8	54.3	93	22	428	2.10	1.00	3.05	5	.2	
June-----	76.0	50.4	63.2	94	34	676	3.08	1.69	4.31	6	.0	
July-----	81.5	54.9	68.2	97	40	848	2.85	1.48	4.05	5	.0	
August-----	80.3	51.9	66.1	99	35	780	2.13	1.04	3.07	5	.0	
September--	68.6	42.3	55.5	93	23	451	2.28	1.00	3.37	4	.0	
October----	55.5	31.7	43.6	82	12	171	1.26	.43	1.94	3	.5	
November---	34.6	16.2	25.4	63	-13	14	.71	.38	1.25	2	5.3	
December---	17.9	-1.4	8.2	46	-30	0	.59	.24	1.04	1	6.9	
Yearly:												
Average---	49.6	26.1	37.8	---	---	---	---	---	---	---	---	
Extreme---	105	-41	---	100	-37	---	---	---	---	---	---	
Total-----	---	---	---	---	---	3,497	18.80	13.61	22.26	42	38.5	

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Argyle, Minnesota)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 13	May 21	May 31
2 years in 10 later than--	May 7	May 16	May 26
5 years in 10 later than--	Apr. 25	May 7	May 17
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 24	Sept. 17	Sept. 6
2 years in 10 earlier than--	Sept. 29	Sept. 22	Sept. 10
5 years in 10 earlier than--	Oct. 10	Oct. 1	Sept. 19

Growing Season

(Recorded in the period 1961-90 at Argyle, Minnesota)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	135	124	103
8 years in 10	144	130	110
5 years in 10	160	142	124
2 years in 10	175	154	137
1 year in 10	184	161	144

General Soil Map Units

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it 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 soils or miscellaneous areas making up one unit 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 or miscellaneous areas can be identified on the map. Likewise, areas that 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.

1. Wahpeton-Fargo Association

Level to gently sloping, moderately well drained and poorly drained soils on flood plains and lake plains

Setting

Landform: Terraces adjacent to large streams and rivers and lake plains
Slope range: 0 to 6 percent

Composition

Percent of the survey area: 2
Extent of the components in the association:
Wahpeton soils: 50 percent
Fargo soils: 40 percent
Soils of minor extent: 10 percent

Soil Properties and Qualities

Wahpeton

Drainage class: Moderately well drained
Position on the landform: Flats, slight rises, and rises
Parent material: Alluvium

Surface texture: Silty clay

Fargo

Drainage class: Poorly drained
Position on the landform: Flats and swales
Parent material: Glaciolacustrine deposits
Surface texture: Silty clay

Minor Soils

- The poorly drained Colvin and Hegne soils on flats and slight rises

Use and Management

Major use: Cropland

2. Colvin-Bearden Association

Level to gently sloping, poorly drained to moderately well drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 6 percent

Composition

Percent of the survey area: 2
Extent of the components in the association (fig. 2):
Colvin soils: 45 percent
Bearden soils: 40 percent
Soils of minor extent: 15 percent

Soil Properties and Qualities

Colvin

Drainage class: Poorly drained
Position on the landform: Flats and swales
Parent material: Glaciolacustrine deposits
Surface texture: Silty clay loam

Bearden

Drainage class: Somewhat poorly drained and moderately well drained
Position on the landform: Flats, slight rises, and backslopes
Parent material: Glaciolacustrine deposits

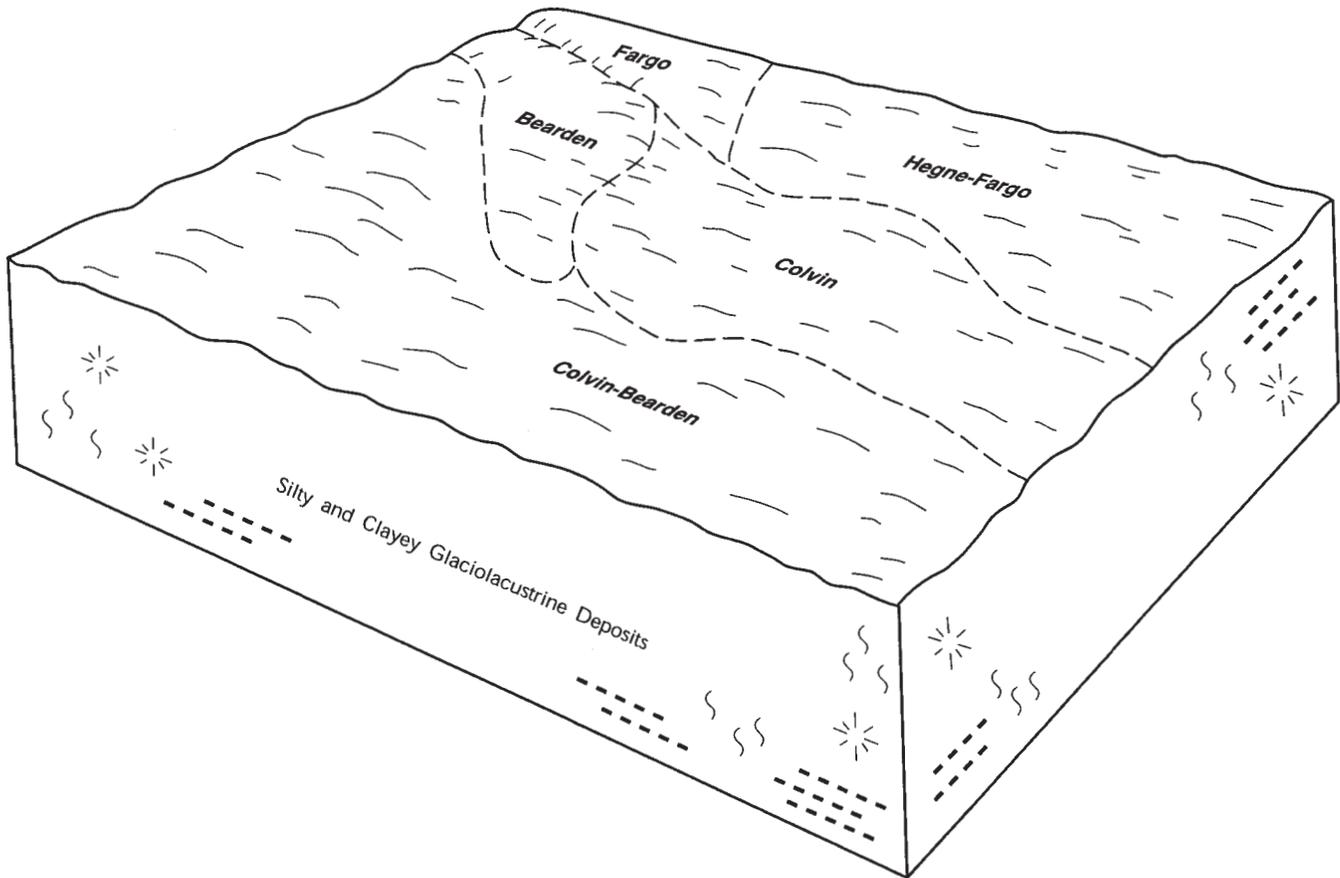


Figure 2.—Typical pattern of soils and underlying material in the Colvin-Bearden association.

Surface texture: Silty clay loam, silt loam

Minor Soils

- The poorly drained Fargo soils on flats and in swales
- The poorly drained Hegne soils on flats and slight rises

Use and Management

Major use: Cropland

3. Northcote-Eaglepoint Association

Level and nearly level, poorly drained and somewhat poorly drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 2 percent

Composition

Percent of the survey area: 4

Extent of the components in the association:

- Northcote soils: 65 percent
- Eaglepoint soils: 20 percent
- Soils of minor extent: 15 percent

Soil Properties and Qualities

Northcote

Drainage class: Poorly drained
Position on the landform: Flats and swales
Parent material: Glaciolacustrine deposits
Surface texture: Clay

Eaglepoint

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits
Surface texture: Clay

Minor Soils

- The poorly drained Fargo soils on flats
- The poorly drained Hegne and Colvin soils on flats and slight rises

- The moderately well drained and somewhat poorly drained Bearden soils on slight rises

Use and Management

Major use: Cropland

4. Fargo-Colvin-Hegne Association

Level and nearly level, poorly drained soils on lake plains

Setting

Landform: Lake plains

Slope range: 0 to 2 percent

Composition

Percent of the survey area: 18

Extent of the components in the association:

Fargo soils: 50 percent

Colvin soils: 20 percent

Hegne soils: 15 percent

Soils of minor extent: 15 percent

Soil Properties and Qualities

Fargo

Drainage class: Poorly drained

Position on the landform: Flats and swales

Parent material: Glaciolacustrine deposits

Surface texture: Silty clay

Colvin

Drainage class: Poorly drained

Position on the landform: Flats and slight rises

Parent material: Glaciolacustrine deposits

Surface texture: Silty clay loam

Hegne

Drainage class: Poorly drained

Position on the landform: Flats and slight rises

Parent material: Glaciolacustrine deposits

Surface texture: Silty clay

Minor Soils

- The moderately well drained and somewhat poorly drained Bearden and Wheatville soils on slight rises
- The poorly drained Lamoure soils on flood plains

Use and Management

Major use: Cropland

5. Wheatville-Glyndon Association

Level to gently sloping, moderately well drained soils on lake plains

Setting

Landform: Lake plains

Slope range: 0 to 6 percent

Composition

Percent of the survey area: 4

Extent of the components in the association (fig. 3):

Wheatville soils: 50 percent

Glyndon soils: 30 percent

Soils of minor extent: 20 percent

Soil Properties and Qualities

Wheatville

Drainage class: Moderately well drained

Position on the landform: Flats and slight rises

Parent material: Glaciolacustrine deposits

Surface texture: Very fine sandy loam

Glyndon

Drainage class: Moderately well drained

Position on the landform: Flats and slight rises

Parent material: Glaciolacustrine deposits

Surface texture: Very fine sandy loam

Minor Soils

- The poorly drained Augsburg and Borup soils on flats
- The poorly drained Clearwater soils on flats and in swales
- The moderately well drained Huot soils on slight rises

Use and Management

Major use: Cropland

6. Ulen-Flaming Association

Level to gently sloping, moderately well drained soils on lake plains

Setting

Landform: Lake plains

Slope range: 0 to 3 percent

Composition

Percent of the survey area: 5

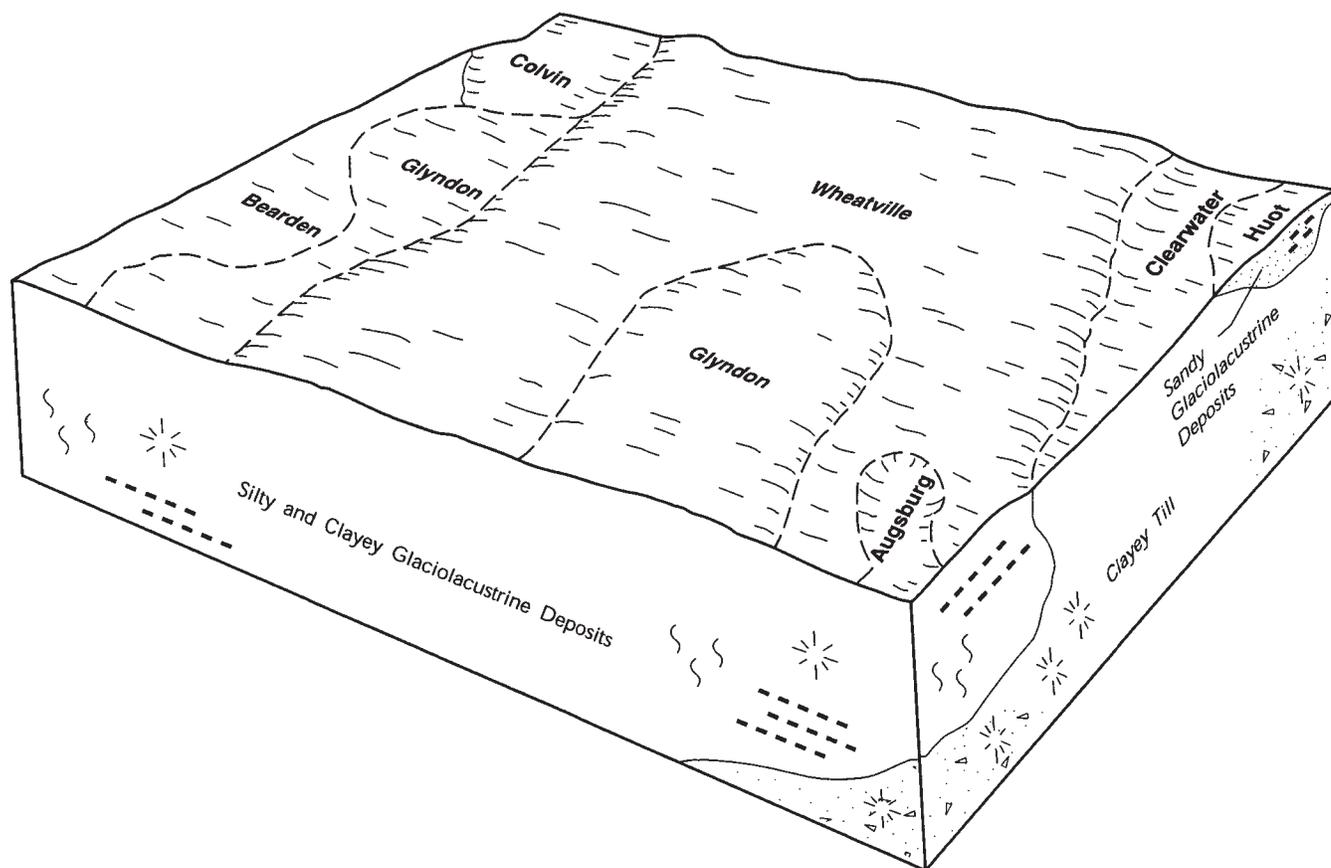


Figure 3.—Typical pattern of soils and underlying material in the Wheatville-Glyndon association.

Extent of the components in the association:

- Ulen soils: 55 percent
- Flaming soils: 30 percent
- Soils of minor extent: 15 percent

Soil Properties and Qualities

Ulen

Drainage class: Moderately well drained
Position on the landform: Slight rises
Parent material: Glaciolacustrine deposits
Surface texture: Loamy fine sand

Flaming

Drainage class: Moderately well drained
Position on the landform: Slight rises
Parent material: Glaciolacustrine deposits
Surface texture: Loamy fine sand

Minor Soils

- The poorly drained Rosewood and Strathcona soils on flats and slight rises

- The poorly drained Hamar soils on flats and in swales
- The moderately well drained Foldahl, Grimstad, and Huot soils on slight rises

Use and Management

Major use: Cropland

7. Sandberg-Strathcona-Syrene Association

Level to gently sloping, excessively drained to poorly drained soils on lake plains and beach ridges

Setting

Landform: Beach ridges, lake plains, and beach plains
Slope range: 0 to 6 percent

Composition

Percent of the survey area: 4

Extent of the components in the association (fig. 4):

- Sandberg soils: 25 percent
- Strathcona soils: 25 percent
- Syrene soils: 15 percent
- Soils of minor extent: 35 percent

Soil Properties and Qualities

Sandberg

Drainage class: Excessively drained
Position on the landform: Summits and backslopes
Parent material: Beach deposits
Surface texture: Loamy sand

Strathcona

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits and till
Surface texture: Fine sandy loam

Syrene

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Beach deposits
Surface texture: Sandy loam

Minor Soils

- The very poorly drained Deerwood and Northwood soils in depressions
- The poorly drained Hamar soils on flats and in swales
- The poorly drained Mavie and Rosewood soils on flats and slight rises
- The moderately well drained Flaming, Foldahl, Grimstad, Radium, and Ulen soils on slight rises

Use and Management

Major uses: Cropland, forage, and pasture

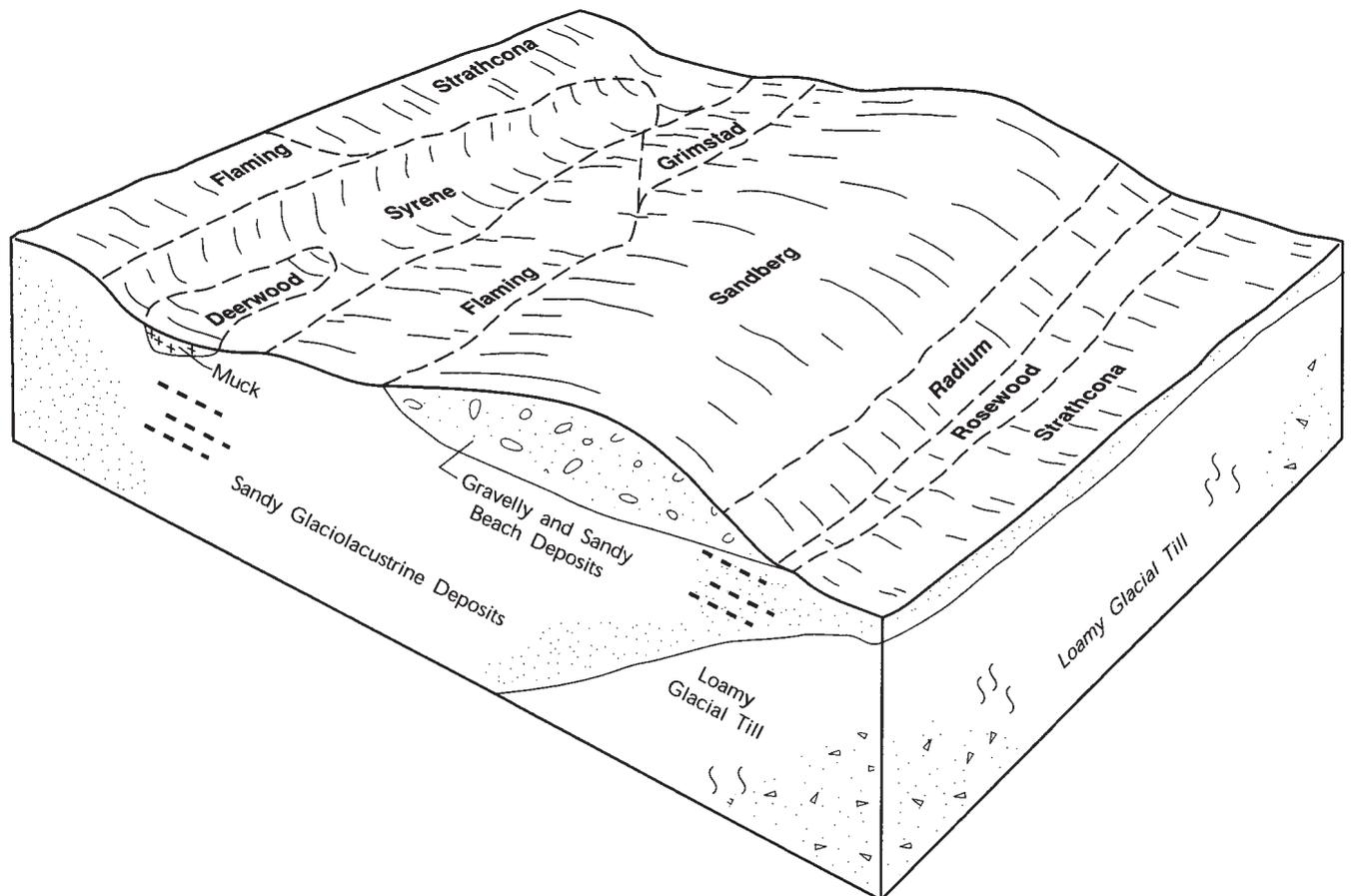


Figure 4.—Typical pattern of soils and underlying material in the Sandberg-Strathcona-Syrene association.

8. Grimstad-Strathcona-Vallers Association

Level to gently sloping, moderately well drained to poorly drained soils on lake plains

Setting

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

Composition

*Percent of the survey area: 9
Extent of the components in the association:
Grimstad soils: 40 percent
Strathcona soils: 15 percent
Vallers soils: 15 percent
Soils of minor extent: 30 percent*

Soil Properties and Qualities

Grimstad

*Drainage class: Moderately well drained
Position on the landform: Slight rises
Parent material: Glaciolacustrine deposits and till
Surface texture: Fine sandy loam*

Strathcona

*Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits and till
Surface texture: Fine sandy loam*

Vallers

*Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Till
Surface texture: Loam*

Minor Soils

- The poorly drained Kratka soils on flats and in swales
- The poorly drained Mavie and Rosewood soils on flats and slight rises
- The moderately well drained Foldahl, Flaming, Huot, Ulen, and Wheatville soils on slight rises

Use and Management

Major uses: Cropland, forage, and pasture

9. Percy-Strathcona-Mavie Association

Level and nearly level, poorly drained soils on lake plains

Setting

*Landform: Lake plains
Slope range: 0 to 2 percent*

Composition

*Percent of the survey area: 6
Extent of the components in the association:
Percy soils: 25 percent
Strathcona soils: 20 percent
Mavie soils: 20 percent
Soils of minor extent: 35 percent*

Soil Properties and Qualities

Percy

*Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Till
Surface texture: Loam*

Strathcona

*Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits and till
Surface texture: Fine sandy loam*

Mavie

*Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits and till
Surface texture: Fine sandy loam*

Minor Soils

- The very poorly drained Haug and Northwood soils in depressions
- The poorly drained Kratka, Smiley, and Strandquist soils on flats and in swales
- The poorly drained Syrene soils on flats and slight rises
- The moderately well drained Foxhome, Nereson, Pelan, and Skagen soils on slight rises

Use and Management

Major uses: Cropland, forage, and pasture

10. Roliss-Vallers-Mavie Association

Level and nearly level, poorly drained soils on lake plains

Setting

*Landform: Lake plains
Slope range: 0 to 2 percent*

Composition

*Percent of the survey area: 12
Extent of the components in the association (fig. 5):
Roliss soils: 25 percent
Vallers soils: 20 percent
Mavie soils: 20 percent
Soils of minor extent: 35 percent*

Soil Properties and Qualities

Roliss

*Drainage class: Poorly drained
Position on the landform: Flats and swales
Parent material: Till*

Surface texture: Loam

Vallers

*Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Till
Surface texture: Loam*

Mavie

*Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits and till
Surface texture: Fine sandy loam*

Minor Soils

- The very poorly drained Hamre, Northwood, and Cathro soils in depressions
- The poorly drained Kratka and Smiley soils on flats and in swales
- The poorly drained Strathcona soils on flats and slight rises
- The moderately well drained Foldahl, Grimstad,

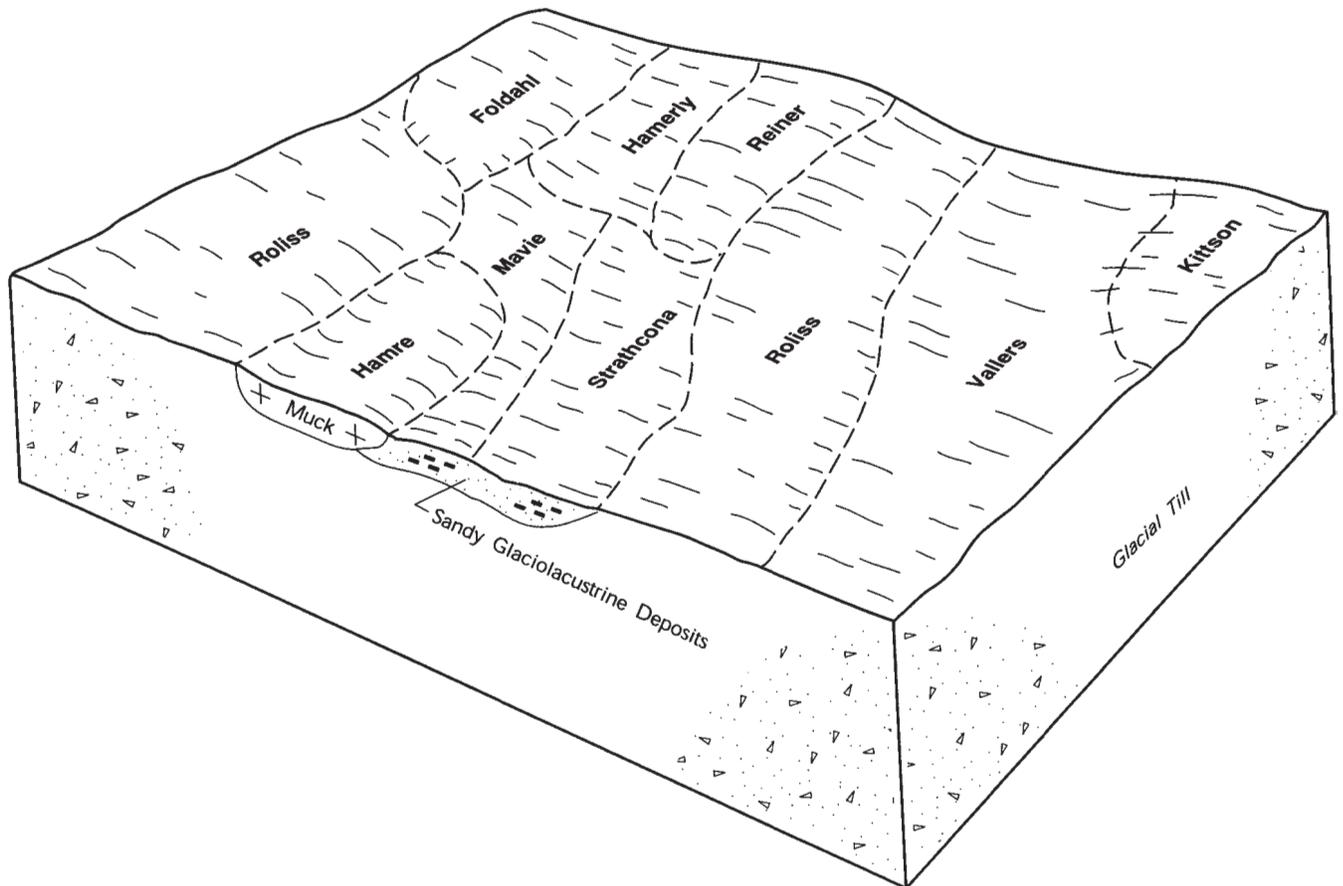


Figure 5.—Typical pattern of soils and underlying material in the Roliss-Vallers-Mavie association.

Hamerly, Kittson, Pelan, and Reiner soils on slight rises

Use and Management

Major uses: Cropland, forage, and pasture

11. Karlstad-Deerwood-Syrene Association

Level to gently sloping, very poorly drained to moderately well drained soils on lake plains and beach plains

Setting

Landform: Lake plains and beach plains

Slope range: 0 to 3 percent

Composition

Percent of the survey area: 5

Extent of the components in the association:

Karlstad soils: 35 percent

Deerwood soils: 30 percent

Syrene soils: 15 percent

Soils of minor extent: 20 percent

Soil Properties and Qualities

Karlstad

Drainage class: Moderately well drained

Position on the landform: Slight rises

Parent material: Beach deposits

Surface texture: Loamy sand

Deerwood

Drainage class: Very poorly drained

Position on the landform: Depressions

Parent material: Organic materials and glaciolacustrine deposits

Surface texture: Muck

Syrene

Drainage class: Poorly drained

Position on the landform: Flats and slight rises

Parent material: Beach deposits

Surface texture: Sandy loam

Minor Soils

- The very poorly drained Markey and Northwood soils in depressions
- The poorly drained Strathcona and Strandquist soils on flats and in swales
- The somewhat poorly drained Redby soils on slight rises

- The moderately well drained Clearriver and Enstrom soils on slight rises
- The excessively drained Corliss and Marquette soils on summits and backslopes

Use and Management

Major uses: Cropland, forage, pasture, and woodland

12. Redby-Northwood-Cormant Association

Level to gently sloping, somewhat poorly drained to very poorly drained soils on lake plains

Setting

Landform: Lake plains

Slope range: 0 to 3 percent

Composition

Percent of the survey area: 1

Extent of the components in the association:

Redby soils: 30 percent

Northwood soils: 25 percent

Cormant soils: 10 percent

Soils of minor extent: 35 percent

Soil Properties and Qualities

Redby

Drainage class: Somewhat poorly drained

Position on the landform: Slight rises

Parent material: Glaciolacustrine deposits

Surface texture: Loamy fine sand

Northwood

Drainage class: Very poorly drained

Position on the landform: Depressions

Parent material: Organic materials and glaciolacustrine deposits or till

Surface texture: Muck

Cormant

Drainage class: Poorly drained

Position on the landform: Flats and swales

Parent material: Glaciolacustrine deposits

Surface texture: Loamy fine sand

Minor Soils

- The very poorly drained Deerwood soils in depressions
- The poorly drained Grygla and Kratka soils on flats and in swales
- The poorly drained Rosewood and Strathcona soils on flats and slight rises

- The moderately well drained Clearriver soils on slight rises

Use and Management

Major uses: Woodland, cropland, and pasture

13. Smiley-Kratka-Reiner Association

Level to gently sloping, poorly drained to moderately well drained soils on lake plains

Setting

Landform: Lake plains

Slope range: 0 to 3 percent

Composition

Percent of the survey area: 17

Extent of the components in the association (fig. 6):

Smiley soils: 35 percent

Kratka soils: 20 percent

Reiner soils: 10 percent

Soils of minor extent: 35 percent

Soil Properties and Qualities

Smiley

Drainage class: Poorly drained

Position on the landform: Flats and swales

Parent material: Till

Surface texture: Loam

Kratka

Drainage class: Poorly drained

Position on the landform: Flats and swales

Parent material: Glaciolacustrine deposits and till

Surface texture: Fine sandy loam

Reiner

Drainage class: Moderately well drained

Position on the landform: Slight rises

Parent material: Till

Surface texture: Fine sandy loam, loamy fine sand

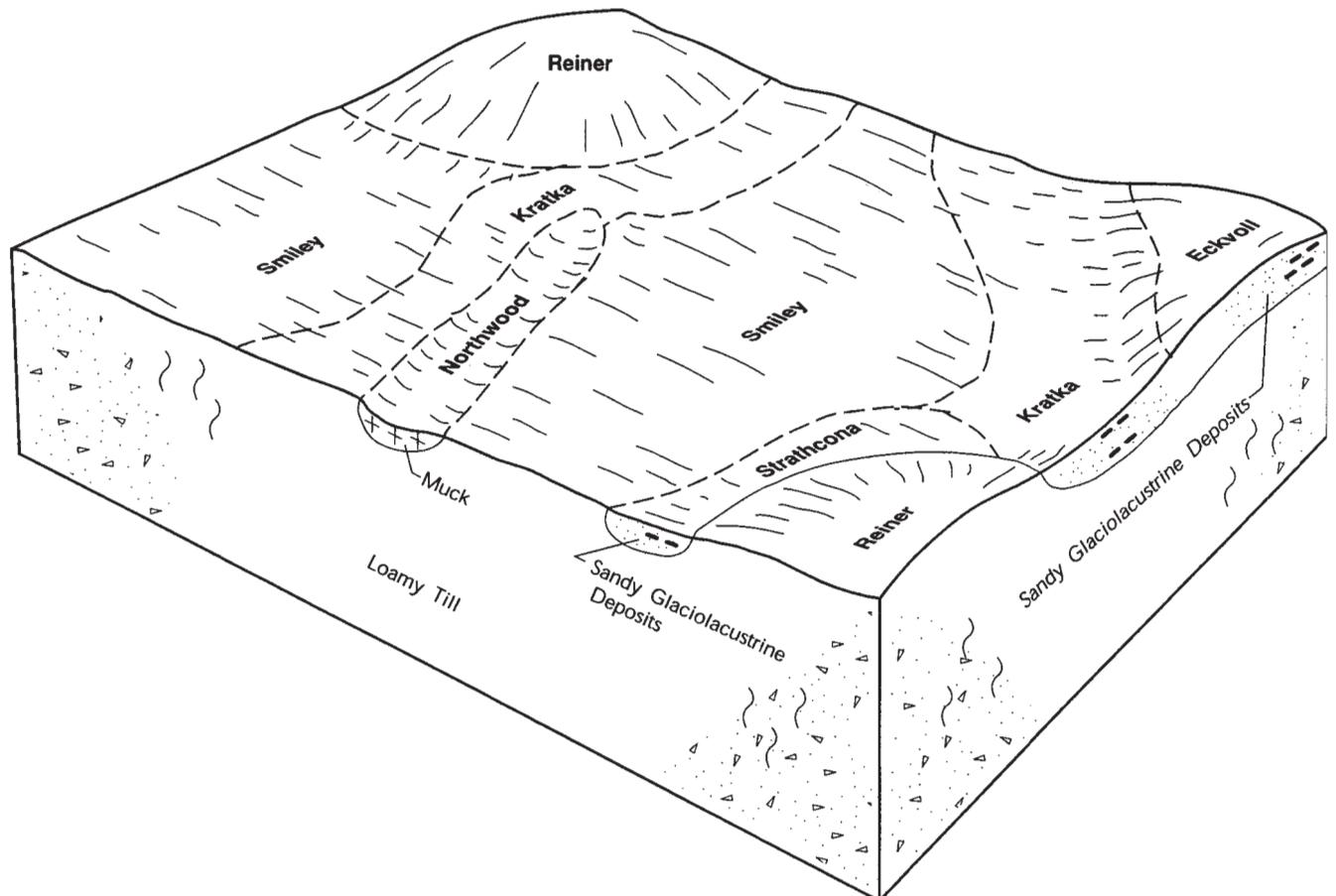


Figure 6.—Typical pattern of soils and underlying material in the Smiley-Kratka-Reiner association.

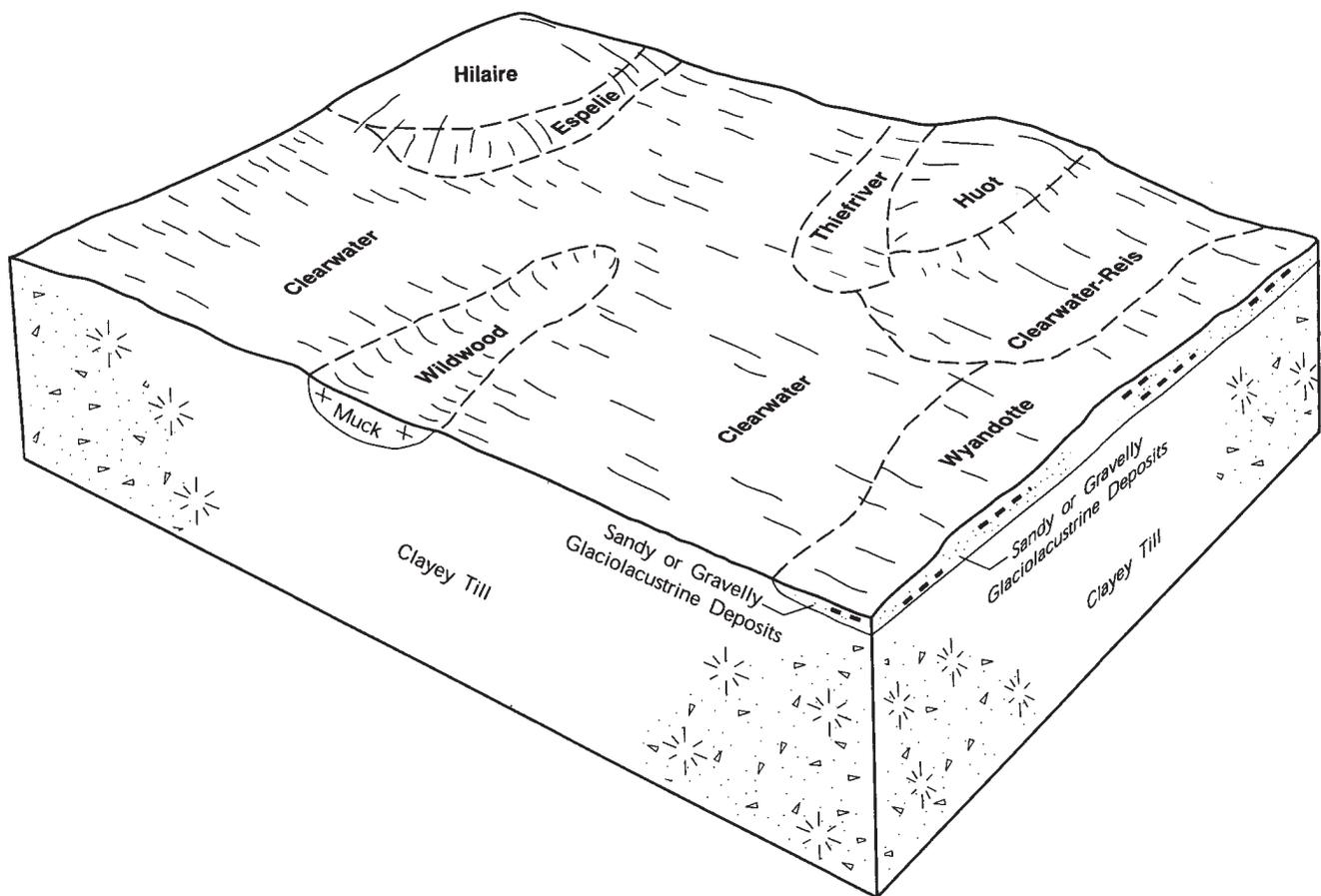


Figure 7.—Typical pattern of soils and underlying material in the Clearwater-Wyandotte association.

Minor Soils

- The very poorly drained Hamre and Northwood soils in depressions
- The poorly drained Roliss and Strandquist soils on flats and in swales
- The poorly drained Strathcona and Vallers soils on flats and slight rises
- The moderately well drained Eckvoll soils on slight rises

Use and Management

Major uses: Cropland, forage, and pasture

14. Clearwater-Wyandotte Association

Level and nearly level, poorly drained soils on lake plains

Setting

Landform: Lake plains

Slope range: 0 to 2 percent

Composition

Percent of the survey area: 4

Extent of the components in the association (fig. 7):

Clearwater soils: 55 percent

Wyandotte soils: 10 percent

Soils of minor extent: 35 percent

Soil Properties and Qualities

Clearwater

Drainage class: Poorly drained

Position on the landform: Flats and swales

Parent material: Till

Surface texture: Loam, clay

Wyandotte

Drainage class: Poorly drained

Position on the landform: Flats and slight rises

Parent material: Glaciolacustrine deposits and till

Surface texture: Clay loam

Minor Soils

- The very poorly drained Wildwood soils in depressions
- The poorly drained Espelie soils on flats and in swales
- The poorly drained Reis and Thiefriver soils on flats and slight rises

- The moderately well drained Hilaire and Huot soils on slight rises

Use and Management

Major uses: Cropland, forage, and pasture



Figure 8.—Many wildlife management areas are in the Cathro-Dora-Wildwood association. These areas provide habitat for deer, moose, gray wolf, and fox.

15. Cathro-Dora-Wildwood Association

Level and nearly level, very poorly drained soils on lake plains

Setting

Landform: Lake plains

Slope range: 0 to 1 percent

Composition

Percent of the survey area: 7

Extent of the components in the association:

Cathro soils: 25 percent

Dora soils: 25 percent

Wildwood soils: 15 percent

Soils of minor extent: 35 percent

Soil Properties and Qualities

Cathro

Drainage class: Very poorly drained

Position on the landform: Depressions

Parent material: Organic materials and glaciolacustrine deposits or till

Surface texture: Muck

Dora

Drainage class: Very poorly drained

Position on the landform: Depressions

Parent material: Organic materials and glaciolacustrine deposits or till

Surface texture: Muck

Wildwood

Drainage class: Very poorly drained

Position on the landform: Depressions

Parent material: Organic materials and glaciolacustrine deposits or till

Surface texture: Muck

Minor Soils

- The very poorly drained Hamre, Haug, Lupton, Markey, Northwood, and Seelyville soils in depressions
- The poorly drained Clearwater, Roliss, and Smiley soils on flats and in swales

Use and Management

Major use: Wildlife habitat (fig. 8)

Formation and Classification of the Soils

This section relates the soils in the survey area to the major factors of soil formation and describes the system of soil classification.

Formation of the Soils

Soil forms as a result of the action of soil-forming processes on materials deposited or accumulated by geologic activity. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the current climate and the climate under which the soil accumulated; the plant and animal life on and in the soil; the relief or topography and the resulting moisture regime; and the length of time the forces of soil formation have acted on the soil. The factors of soil formation are interdependent and must be considered together when theories regarding the development of a certain soil are formulated.

Climate

Climate affects the physical, chemical, and biological characteristics of the soil. Precipitation, humidity, and frost influence the availability of moisture and the rate of percolation of water through the soil. The movement of water dissolves minerals and transports them in the soil mass. Temperature influences formation by regulating the growth of organisms and the speed of chemical reactions.

Marshall County has a subhumid, continental climate characterized by wide variations in temperature from summer to winter. The winters are long, and the soil is frozen to a depth of 3 to 5 feet for nearly 6 months of the year. During this time the soil-forming processes are largely dormant, except for frost action.

There is slightly more rainfall in the eastern part of the county than in the western part. This difference in the amount of rainfall has produced two types of native vegetation. The soils in the eastern part of Marshall County developed under savannah or forest vegetation, and the soils in the western part formed under prairie vegetation.

Soils that formed in areas of low precipitation in the western part of the survey area have more

soluble or colloidal material in the upper part of the profile than other soils, and carbonates at the surface are common. Colvin and Bearden soils are examples. Both of these soils contain a layer of concentrated carbonates in the upper 16 inches. In the soils that formed in areas of higher precipitation in the eastern part of the county, however, most of the carbonates or colloidal clay has been leached from the surface layer and has accumulated below this layer. Smiley, Reiner, and Eckvoll soils are examples of soils that have a layer of clay accumulation. Carbonates are below the accumulated clay.

Living Organisms

All forms of life, both in and on the soil, influence the chemical and biological processes in the soil. Bacteria, earthworms, insects, and other forms of animal life aid in the weathering of materials and the decomposition of organic matter.

Small burrowing animals and larger game animals alter the soil with their droppings and through their browsing of vegetation.

Humans also influence the development of soils by disturbing the natural balance of certain factors and altering related conditions. When natural vegetation is removed and the soil is tilled, erosion is accelerated. Changes in drainage or relief also influence soil development. Cultivation and additions of fertilizer can modify the natural soil-forming processes.

Vegetation and fungi influence soil formation by returning residue to the soil and aiding in decomposition. Plants and plantlike organisms can also influence the transfer of elements within the soil by their influence on soil pH and interaction with other soil-forming factors, such as climate and relief.

The native vegetation in Marshall County can be divided into two types. The western part of the county was once tall grass prairie and wetland reeds and sedges. Some of the prairie vegetation included big bluestem, Canada wildrye, prairie cordgrass, needleandthread, indiangrass, porcupinegrass, and switchgrass. Fire limited some of the tree growth in this area. The soils of the native prairie have a deep, dark surface layer and are rich in organic matter and nutrients. The second type of native vegetation,

mixed hardwoods, is in areas east of the Thief River. Bur oak, quaking aspen, and birch are among the hardwood species in this type of vegetation. The surface layer of soils in the forested regions is not as rich in organic matter as that of the prairie soils. Some of the soils that formed under forest vegetation have a lower content of calcium carbonate than the soils that formed under prairie vegetation.

Hardwoods, such as ash, elm, and poplar, are along major stream terraces. These trees aid in stabilizing the soil along the streambanks.

The vegetation on the beach ridges west of the Thief River is a mixture of both prairie and hardwoods. Many of the soils in the county are influenced by this transitional zone and exhibit characteristics of both prairie and forested soils.

Parent Material

The soils of Marshall County formed in three major kinds of parent material. These are calcareous lacustrine deposits in the basin of Glacial Lake Agassiz, calcareous glacial till that was modified and reworked by Lake Agassiz, and alluvial (river) deposits. Glacial Lake Agassiz covered the entire county after the glacier receded. Loamy glacial till underlies all of the present glacial lake sediment at varying depths. The difference in the depth to the glacial till, which is at or near the surface in about two-thirds of the county, accounts for many of the differences in the soils.

The western one-third of the county is a nearly level glacial lake plain. Lacustrine sediment of silt and clay was deposited in lake basins in the western one-fourth of the county. This lacustrine material contains 35 to 75 percent clay and commonly contains less than 5 percent sand. Generally, these soils do not contain rocks or pebbles. Lacustrine sand was deposited on sandbars and deltas and in interbeach areas throughout the rest of this one-third of the county. Most of the soils in this part of the county are poorly drained. Along the eastern border of the glacial lake plain are glacial beach deposits of sand and gravel. Also, sand and gravel ridges scattered throughout the eastern two-thirds of the county are further evidence of the receding shoreline of Glacial Lake Agassiz. The beach deposits and ridges are mostly moderately well drained to excessively drained.

Most of the eastern two-thirds of the county is a nearly level glacial till plain that has been reworked by Glacial Lake Agassiz. This reworking by Lake Agassiz is evidenced by a lag line of stones and gravel at or near the surface. This calcareous till is commonly loam or clay loam. It may contain from 20

to 60 percent sand and at least a small amount of gravel. Most of the soils are poorly drained.

There are several large areas of organic soils in the eastern two-thirds of the county. These soils accumulated from the remains of plants in low areas where there was an abundance of water (Wright, 1972).

A small number of soils were influenced by alluvial action. These soils are adjacent to streams and rivers where the soil was carried, sorted, and redeposited.

Relief

Relief influences soil formation by affecting the relationships among soil temperature, water, erosion, and vegetation. Relief is a minor topographic feature in Marshall County but is an important factor in differentiating soils that formed in similar parent material. In Marshall County it is the micro-relief (slight rises) that distinguishes between some of the soils. For example, Grimstad and Strathcona soils are very similar, but Grimstad soils are on the slight rises and Strathcona soils are in the lower areas. The position of the Grimstad soils on slight rises has an impact on drainage and thus affects the use of these soils for farming, building site development, and engineering uses.

Another example of the effects of micro-relief is in complexes consisting of two poorly drained soils, such as Hegne and Fargo soils. These soils have similar textures, but one of the soils is slightly higher on the landscape than the other. The soil in the higher areas has a higher concentration of carbonates in the upper part than the soil in the lower areas. This concentration of carbonates affects the pH of the soil and the uptake of nutrients.

Because Marshall County has level to gently sloping topography, many of the soils are poorly drained and have a high content of organic matter, have color alterations or mottling, and have a high concentration of carbonates. Soils in the deeper depressions have an organic surface layer and a high water table.

Time

Long periods of time are required for the factors of soil formation to produce a soil profile from the parent material. Much less time is needed for soils to form in warm, humid regions with dense vegetation than in dry, cold regions with little plant life. Drainage also influences how quickly a soil develops. The soils in well drained areas develop more rapidly than those in areas that are less well drained. The nature of the plant material also influences how quickly a soil

forms. Glacial till or lacustrine sediment generally develops into a soil much faster than bedrock.

All of the soils in Marshall County are geologically young. Most of the parent material was deposited 9,000 to 12,000 years ago. The parent material was deposited by the most recent glacier and subsequent stages of Glacial Lake Agassiz.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1975). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The table "Classification of the Soils" in Parts I and II of this publication shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is

identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Endoaquolls (*Endo*, meaning within, plus *aquoll*, the suborder of the Mollisols that has an aquic moisture regime).

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

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

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Classification of the Soils

Soil name	Family or higher taxonomic class
Augsburg-----	Typic Calciaquolls, coarse-silty over clayey, mixed, smectitic, superactive, frigid
Bearden-----	Aeric Calciaquolls, fine-silty, mixed, superactive, frigid
Berner-----	Terric Borosaprists, loamy, mixed, euic
Boash-----	Vertic Epiaquolls, clayey over loamy, smectitic, mixed, superactive, calcareous, frigid
Borup-----	Typic Calciaquolls, coarse-silty, mixed, superactive, frigid
Cathro-----	Terric Borosaprists, loamy, mixed, euic
Clearriver-----	Aquic Udipsamments, mixed, frigid
Clearwater-----	Typic Epiaquerts, fine, smectitic, frigid
Colvin-----	Typic Calciaquolls, fine-silty, mixed, superactive, frigid
Corliiss-----	Typic Udipsamments, mixed, frigid
Cormant-----	Mollic Psammaquents, mixed, frigid
Deerwood-----	Histic Humaquepts, sandy, mixed, frigid
Dora-----	Terric Borosaprists, clayey, smectitic, euic
Eaglepoint-----	Aeric Calciaquerts, very fine, smectitic, frigid
Eckvoll-----	Aquic Arenic Eutroboralfs, loamy, mixed, superactive
Enstrom-----	Aquic Udorthents, sandy over loamy, mixed, superactive, nonacid, frigid
Espelie-----	Typic Epiaquolls, sandy over clayey, mixed, smectitic, frigid
Fargo-----	Typic Epiaquerts, fine, smectitic, frigid
Flaming-----	Aquic Haploborolls, sandy, mixed
Fluvaquents-----	Fluvaquents, loamy
Foldahl-----	Aquic Haploborolls, sandy over loamy, mixed, superactive
Foxhome-----	Aquic Haploborolls, sandy-skeletal over loamy, mixed, superactive
Garnes-----	Aquic Eutroboralfs, fine-loamy, mixed, superactive
Glyndon-----	Aeric Calciaquolls, coarse-silty, mixed, superactive, frigid
Grimstad-----	Aeric Calciaquolls, sandy over loamy, mixed, superactive, frigid
Grygla-----	Mollic Endoaquents, sandy over loamy, mixed, superactive, nonacid, frigid
Hamar-----	Typic Endoaquolls, sandy, mixed, frigid
Hamerly-----	Aeric Calciaquolls, fine-loamy, mixed, superactive, frigid
Hamre-----	Histic Humaquepts, fine-loamy, mixed, superactive, nonacid, frigid
Hangaard-----	Typic Endoaquolls, sandy, mixed, frigid
Haploborolls-----	Haploborolls, loamy
Haug-----	Histic Humaquepts, coarse-loamy, mixed, superactive, calcareous, frigid
Hegne-----	Typic Calciaquerts, fine, smectitic, frigid
Hilaire-----	Aquic Haploborolls, sandy over clayey, mixed, smectitic
Huot-----	Aquic Calciborolls, sandy over clayey, mixed, smectitic
Karlstad-----	Aquic Eutroboralfs, coarse-loamy, mixed, superactive
Kittson-----	Aquic Haploborolls, fine-loamy, mixed, superactive
Kratka-----	Typic Epiaquolls, sandy over loamy, mixed, superactive, frigid
Lamoure-----	Cumulic Endoaquolls, fine-silty, mixed, superactive, calcareous, frigid
Linveltdt-----	Aquic Argiborolls, coarse-loamy, mixed, superactive
Lupton-----	Typic Borosaprists, euic
Markey-----	Terric Borosaprists, sandy or sandy-skeletal, mixed, euic
Marquette-----	Ochreptic Eutroboralfs, loamy-skeletal, mixed, superactive
Mavie-----	Typic Calciaquolls, sandy-skeletal over loamy, mixed, superactive, frigid
Nereson-----	Aquic Argiborolls, coarse-loamy, mixed, superactive
Newfolden-----	Abruptic Udic Argiborolls, clayey over loamy, smectitic, mixed, superactive
Northcote-----	Typic Epiaquerts, very fine, smectitic, frigid
Northwood-----	Histic Humaquepts, sandy over loamy, mixed, superactive, nonacid, frigid
Pelan-----	Aquic Argiborolls, loamy-skeletal, mixed, superactive
Percy-----	Typic Calciaquolls, coarse-loamy, mixed, superactive, frigid
Poppleton-----	Aquic Udipsamments, mixed, frigid
Radium-----	Aquic Haploborolls, sandy, mixed
Redby-----	Aquic Udipsamments, mixed, frigid
Reiner-----	Abruptic Udic Argiborolls, fine-loamy, mixed, superactive
Reis-----	Typic Calciaquerts, fine, smectitic, frigid
Rifle-----	Typic Borohemists, euic
Roliss-----	Typic Endoaquolls, fine-loamy, mixed, superactive, calcareous, frigid
Rosewood-----	Typic Calciaquolls, sandy, mixed, frigid
Rushlake-----	Aquic Udipsamments, mixed, frigid
Sahkahtay-----	Mollic Endoaqualfs, fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid
Sandberg-----	Udorthentic Haploborolls, sandy, mixed
Seelyeville-----	Typic Borosaprists, euic

Classification of the Soils--Continued

Soil name	Family or higher taxonomic class
Skagen-----	Aquic Calciborolls, coarse-loamy, mixed, superactive
Smiley-----	Typic Argiaquolls, fine-loamy, mixed, superactive, frigid
Strandquist-----	Typic Endoquolls, sandy-skeletal over loamy, mixed, superactive, calcareous, frigid
Strathcona-----	Typic Calciaquolls, sandy over loamy, mixed, superactive, frigid
Syrene-----	Typic Calciaquolls, sandy, mixed, frigid
Tacoosh-----	Terric Borohemists, loamy, mixed, euic
Thiefriever-----	Typic Calciaquolls, sandy over clayey, mixed, smectitic, frigid
Udipsamments-----	Udipsamments
Ulen-----	Aeric Calciaquolls, sandy, mixed, frigid
Vallars-----	Typic Calciaquolls, fine-loamy, mixed, superactive, frigid
Wahpeton-----	Typic Hapluderts, fine, smectitic, frigid
Wheatville-----	Aeric Calciaquolls, coarse-silty over clayey, mixed, smectitic, superactive, frigid
Wildwood-----	Histic Humaquepts, very fine, smectitic, nonacid, frigid
Wyandotte-----	Typic Calciaquolls, sandy-skeletal over clayey, smectitic, frigid

Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
47	Colvin silty clay loam-----	14,951	1.3
57A	Fargo silty clay, 0 to 2 percent slopes-----	70,440	6.1
58	Kittson loam-----	5,576	0.5
59	Grimstad fine sandy loam-----	46,086	4.0
65	Foxhome sandy loam-----	6,380	0.5
66	Flaming loamy fine sand-----	20,883	1.8
67A	Bearden silt loam, 0 to 2 percent slopes-----	5,355	0.5
67B	Bearden silt loam, 2 to 6 percent slopes-----	2,201	0.2
77	Garnes fine sandy loam-----	1,342	0.1
93A	Bearden silty clay loam, 0 to 2 percent slopes-----	1,609	0.1
111	Hangaard sandy loam-----	1,423	0.1
116	Redby loamy fine sand-----	4,196	0.4
117	Cormant loamy fine sand-----	1,472	0.1
145	Enstrom loamy fine sand-----	2,331	0.2
148	Poppleton fine sand-----	7,168	0.6
157A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded-----	10,307	0.9
157B	Wahpeton silty clay, 2 to 6 percent slopes, occasionally flooded-----	925	*
184A	Hamerly loam, 0 to 3 percent slopes-----	2,281	0.2
187	Haug muck-----	6,665	0.6
205	Karlstad loamy sand-----	6,969	0.6
236	Vallers loam-----	28,436	2.4
242B	Marquette loamy sand, 1 to 8 percent slopes-----	2,331	0.2
258B	Sandberg loamy sand, 1 to 6 percent slopes-----	10,589	0.9
280	Pelan sandy loam-----	9,452	0.8
372	Hamar loamy fine sand-----	540	*
379	Percy loam, very cobbly-----	1,164	0.1
383	Percy loam-----	11,958	1.0
384	Percy mucky loam, depressional-----	785	*
387	Roliss loam, depressional-----	2,504	0.2
412	Mavie fine sandy loam-----	31,967	2.8
418	Lamoure silty clay loam, occasionally flooded-----	1,749	0.2
426	Foldahl loamy fine sand-----	13,202	1.1
429A	Northcote clay, 0 to 2 percent slopes-----	23,470	2.0
432	Strandquist loam-----	10,236	0.9
435	Syrene sandy loam-----	9,572	0.8
439	Strathcona fine sandy loam-----	45,792	3.9
481	Kratka fine sandy loam-----	37,461	3.2
482	Grygla loamy fine sand-----	2,652	0.2
514	Tacoosh muck-----	2,410	0.2
540	Seelyeville muck-----	6,331	0.5
541	Rifle mucky peat-----	7,818	0.7
543	Markey muck-----	10,118	0.9
544	Cathro muck-----	11,884	1.0
546	Lupton muck-----	2,503	0.2
547	Deerwood muck-----	7,387	0.6
550	Dora muck-----	10,543	0.9
563	Northwood muck-----	28,967	2.5
565	Eckvoll loamy fine sand-----	9,208	0.8
582	Roliss loam-----	28,970	2.5
583	Nereson fine sandy loam-----	2,626	0.2
630	Wildwood muck-----	4,800	0.4
641	Clearwater clay-----	8,726	0.8
642	Clearwater loam-----	20,639	1.8
643	Huot fine sandy loam-----	10,479	0.9
644	Boash clay loam-----	3,583	0.3
645	Espelie fine sandy loam-----	4,653	0.4
647	Hilaire loamy fine sand-----	3,311	0.3
648	Newfolden loam-----	1,161	0.1
649	Reiner loamy fine sand-----	3,133	0.3
650	Reiner fine sandy loam-----	16,916	1.4
651	Thiefriver fine sandy loam-----	3,271	0.3
652	Wyandotte clay loam-----	5,651	0.5

See footnote at end of table.

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
653	Smiley mucky loam, depressiona-----	4,023	0.3
708	Rushlake loamy sand-----	1,929	0.2
712	Rosewood fine sandy loam-----	16,264	1.4
713	Linveltdt fine sandy loam-----	2,528	0.2
721B	Corliss loamy sand, 1 to 6 percent slopes-----	2,188	0.2
765	Smiley loam-----	68,137	5.9
794	Clearriver loamy fine sand-----	4,076	0.4
935	Hegne-Fargo complex-----	51,548	4.4
936	Clearwater-Reis complex-----	2,646	0.2
937	Eaglepoint-Northcote complex-----	15,927	1.4
972	Roliss-Vallers complex-----	33,450	2.9
1006	Fluvaquents-Haploborolls complex, 0 to 30 percent slopes, flooded-----	10,864	0.9
1030	Pits, gravel-Udipsamments complex-----	2,996	0.2
1031	Seelyeville muck, ponded-----	1,071	*
1143	Berner-Markey complex-----	1,525	0.1
1144	Strathcona and Kratka soils, depressiona-----	4,595	0.4
1146	Northwood muck, ponded-----	785	*
1158	Skagen loam-----	711	*
1170	Skagen loam, very cobbly-----	797	*
1187	Dora muck, ponded-----	8,685	0.7
1188	Wildwood muck, ponded-----	7,271	0.6
1189	Clearwater mucky loam, depressiona-----	2,664	0.2
1191	Sahkahtay sandy loam-----	897	*
1264	Ulen loamy fine sand-----	44,686	3.8
1297	Augsburg very fine sandy loam-----	1,784	0.2
1299	Borup very fine sandy loam-----	3,418	0.3
1304A	Glyndon very fine sandy loam, 0 to 2 percent slopes-----	15,828	1.4
1304B	Glyndon very fine sandy loam, 2 to 6 percent slopes-----	559	*
1315A	Wheatville very fine sandy loam, 0 to 2 percent slopes-----	23,707	2.0
1804	Hamre muck, ponded-----	8,950	0.8
1807	Cathro muck, ponded-----	7,985	0.7
1808	Markey muck, ponded-----	1,140	*
1871	Fargo silty clay, swales-----	635	*
1874	Radium loamy sand-----	4,904	0.4
1878	Hamre muck-----	13,776	1.2
1882	Rosewood, Strathcona, and Berner soils, seepy-----	476	*
1963	Bearden-Colvin complex-----	24,486	2.1
1964	Colvin-Fargo complex-----	50,560	4.4
1966	Rosewood-Hamar complex-----	321	*
	Water-----	33,800	2.9
	Total-----	1,160,100	100.0

* Less than 0.1 percent.

This page intentionally left blank.

Soil Series and Detailed Soil Map Units

In this section, arranged in alphabetical order, each soil series recognized in the survey area is described. Each description is followed by the detailed soil map units associated with the series.

Characteristics of the soil and the material in which it formed are identified for each soil series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1975). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units 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 in Part II of this survey.

A map unit delineation on the detailed soil maps represents an area on the landscape and consists of one or more soils or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas 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 description. 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 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 soil 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 segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but 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. The principal hazards and limitations to be considered in planning for specific uses are described in Part II of this survey.

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

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that

affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Fargo silty clay, 0 to 2 percent slopes, is a phase of the Fargo series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are 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. Hegne-Fargo complex 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. Strathcona and Kratka soils, depressional, 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 Pits component of the Pits, gravel-Udipsamments complex is an example.

The table "Acreage and Proportionate Extent of the Soils" in Parts I and II of this survey 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.

Augsburg Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Upper part—moderately rapid; lower part—slow or very slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 2 percent

Taxonomic classification: Coarse-silty over clayey, mixed over smectitic, superactive, frigid Typic Calciaquolls

Typical Pedon

Augsburg very fine sandy loam, 250 feet south and 1,100 feet east of the northwest corner of sec. 30, T. 155 N., R. 47 W.

Ap—0 to 9 inches; black (10YR 2/1) very fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few very fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg1—9 to 16 inches; grayish brown (2.5Y 5/2) loamy very fine sand; common fine and medium distinct light olive brown (2.5Y 5/6) iron concentrations; weak fine subangular blocky structure; very friable; few very fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg2—16 to 29 inches; light brownish gray (2.5Y 6/2) loamy very fine sand; common medium distinct light olive brown (2.5Y 5/6) and many medium distinct light yellowish brown (2.5Y 6/4) iron concentrations; weak fine subangular blocky structure; very friable; few very fine roots; few soft masses of carbonates; strongly effervescent; moderately alkaline; abrupt wavy boundary.

2Bg—29 to 60 inches; olive gray (5Y 4/2) clay; many fine and medium faint dark olive gray (5Y 3/2) iron depletions and common fine faint olive (5Y 4/3) iron concentrations; weak very fine angular blocky structure; firm; few fine threads of carbonate; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 13 inches

Thickness of the surface mantle: 20 to 40 inches

A horizon:

Hue—10YR

Value—2

Chroma—1

Texture—very fine sandy loam

Bkg horizon:

Hue—2.5Y

Value—5 or 6

Chroma—1 or 2

Texture—loamy very fine sand, very fine sandy loam, or silt loam

2Bg horizon:

Hue—2.5Y or 5Y

Value—3 or 4

Chroma—1 or 2

Texture—clay

1297—Augsburg very fine sandy loam**Composition**

Augsburg and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Very fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 9.6 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Wheatville and similar soils
- Borup and similar soils
- Glyndon and similar soils
- Thiefriver and similar soils
- Fargo and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Bearden Series

Depth class: Very deep

Drainage class: Somewhat poorly drained or moderately well drained

Permeability: Moderate or moderately slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 6 percent

Taxonomic classification: Fine-silty, mixed, superactive, frigid Aeric Calcicquolls

Typical Pedon

Bearden silt loam, 0 to 2 percent slopes, 300 feet north and 500 feet east of the southwest corner of sec. 28, T. 155 N., R. 49 W.

Ap—0 to 9 inches; black (N 2/0) silt loam, black (10YR 2/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—9 to 16 inches; grayish brown (10YR 5/2) silt loam; weak medium subangular blocky structure; friable; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—16 to 24 inches; light olive brown (2.5Y 5/4) silt loam; many medium distinct olive gray (5Y 5/2) iron depletions; weak medium subangular blocky structure; friable; disseminated carbonates; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bw—24 to 29 inches; light olive brown (2.5Y 5/4) silt loam; common fine prominent dark yellowish brown (10YR 4/6) iron concentrations and common fine distinct grayish brown (2.5Y 5/2) iron depletions; weak medium subangular blocky structure; friable; few soft masses of carbonates; few fine very dark brown (10YR 2/2) manganese concretions; slightly effervescent; slightly alkaline; gradual wavy boundary.

C—29 to 60 inches; light olive brown (2.5Y 5/4) silt loam; many fine prominent dark yellowish brown (10YR 4/6) and many fine and medium distinct olive yellow (2.5Y 6/6) iron concentrations and many fine and medium faint olive gray (5Y 4/2) and light olive gray (5Y 6/2) iron depletions; massive with weak medium platy and subangular blocky soil fragments; friable; common medium very dark brown (10YR 2/2) manganese coatings on faces of peds; common medium soft masses of carbonates; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 19 inches

A horizon:

Hue—neutral, 10YR, 2.5Y, or 5Y

Value—2 or 3

Chroma—0 or 1

Texture—silt loam or silty clay loam

Bk horizon:

Hue—10YR, 2.5Y, or 5Y

Value—3 to 6

Chroma—1 to 4
Texture—silt loam or silty clay loam

Bw horizon:

Hue—2.5Y
Value—5
Chroma—4
Texture—silty clay loam or silt loam

C horizon:

Hue—2.5Y or 5Y
Value—4 or 5
Chroma—2 to 4
Texture—silty clay loam or silt loam

67A—Bearden silt loam, 0 to 2 percent slopes

Composition

Bearden and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Colvin and similar soils
- Fargo and similar soils
- Glyndon and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

67B—Bearden silt loam, 2 to 6 percent slopes

Composition

Bearden and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Lake plains
Position on the landform: Backslopes
Slope: 2 to 6 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Colvin and similar soils
- Fargo and similar soils
- Glyndon and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

93A—Bearden silty clay loam, 0 to 2 percent slopes

Composition

Bearden and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.5 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Colvin and similar soils
- Fargo and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1963—Bearden-Colvin complex

Composition

Bearden and similar soils: About 50 percent
 Colvin and similar soils: About 40 percent
 Inclusions: About 10 percent

Setting

Landform: Bearden—flats and slight rises on lake plains; Colvin—swales on lake plains
Slope: 0 to 2 percent

Component Description

Bearden

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.5 inches
Organic matter content: High

Colvin

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.9 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Fargo and similar soils
- Hegne and similar soils
- Glyndon and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Berner Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderately slow to moderately rapid; next part—rapid; lower part—moderate or moderately slow
Landform: Lake plains
Parent material: Organic materials and glaciolacustrine deposits or till
Slope range: 0 to 1 percent
Taxonomic classification: Loamy, mixed, euc Terric Borosaprists

Typical Pedon

Berner muck, in an area of Berner-Markey complex, 2,600 feet north and 400 feet west of the southeast corner of sec. 6, T. 154 N., R. 44 W.

- Oa1—0 to 7 inches; dark brown (7.5YR 3/2) muck; 40 percent fiber, 10 percent rubbed; weak thin platy structure; very friable; common fine roots; moderately acid; clear smooth boundary.
 Oa2—7 to 18 inches; dark brown (7.5YR 3/2) muck;

40 percent fiber, 10 percent rubbed; weak thick platy structure parting to weak thin platy; very friable; few fine roots; slightly acid; abrupt smooth boundary.

Oa3—18 to 29 inches; black (10YR 2/1) muck; 10 percent fiber, trace of fiber rubbed; massive; very friable; moderately acid; clear smooth boundary.

Oa4—29 to 33 inches; black (N 2/0) muck; 5 percent fiber, trace of fiber rubbed; massive; very friable; slightly acid; abrupt smooth boundary.

Cg1—33 to 44 inches; light brownish gray (2.5Y 6/2) gravelly sand; single grain; loose; 15 percent gravel; strongly effervescent; slightly alkaline; abrupt smooth boundary.

2Cg2—44 to 60 inches; gray (5Y 5/1) clay loam; massive with fine and medium blocky soil fragments; friable; many soft masses of carbonates; 5 percent gravel; moderately alkaline.

Range in Characteristics

Depth to carbonates: 21 to 51 inches

Thickness of the histic epipedon: 16 to 34 inches

Depth to glacial till: 30 to 45 inches

Other features: An A horizon in some pedons

Oa horizon:

Hue—10YR, 7.5YR, or neutral

Value—2 to 4

Chroma—0 to 3

Texture—muck

A horizon (if it occurs):

Hue—neutral

Value—2

Chroma—0

Texture—fine sandy loam or loamy sand

Cg horizon:

Hue—2.5Y

Value—4 to 6

Chroma—1 or 2

Texture—gravelly sand, sand, gravelly coarse sand, coarse sand, or fine sand

Content of rock fragments—5 to 20 percent

2Cg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—1 or 2

Texture—clay loam, loam, fine sandy loam, or sandy loam

Content of rock fragments—3 to 10 percent

1143—Berner-Markey complex

Composition

Berner and similar soils: About 55 percent
Markey and similar soils: About 30 percent
Inclusions: About 15 percent

Setting

Landform: Depressions on lake plains

Slope: 0 to 1 percent

Component Description

Berner

Surface layer texture: Muck

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Organic materials and glaciolacustrine deposits or till

Flooding: None

Seasonal high water table: 1.0 foot above to 0.5 foot below the surface

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 17.4 inches

Organic matter content: Very high

Markey

Surface layer texture: Muck

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Organic materials and glaciolacustrine deposits

Flooding: None

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

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 13.3 inches

Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Seelyeville and similar soils
- Northwood and similar soils
- Deerwood and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Boash Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Upper part—slow; lower part—moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 2 percent

Taxonomic classification: Clayey over loamy, calcareous, smectitic over loamy, mixed, superactive, frigid Vertic Epiaquolls

Typical Pedon

Boash clay loam, 2,100 feet south and 800 feet east of the northwest corner of sec. 20, T. 155 N., R. 42 W.

Ap—0 to 7 inches; black (N 2/0) clay loam, very dark gray (N 3/0) dry; weak medium subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.

Bg1—7 to 22 inches; olive gray (5Y 4/2) silty clay; few fine prominent dark yellowish brown (10YR 4/6) iron concentrations; moderate medium subangular blocky structure; firm; few fine threads of carbonate; 2 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.

Bg2—22 to 33 inches; dark gray (5Y 4/1) silty clay; few fine prominent dark yellowish brown (10YR 4/6) iron concentrations; moderate fine subangular blocky structure; firm; few fine threads of carbonate; 2 percent gravel; strongly effervescent; slightly alkaline; clear wavy boundary.

2Bkg—33 to 60 inches; grayish brown (2.5Y 5/2) loam; few medium prominent olive yellow (2.5Y 6/6) iron concentrations; weak fine subangular blocky structure; friable; common fine threads of carbonate; 3 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: Less than 10 inches

Thickness of the mollic epipedon: 7 to 20 inches

Thickness of the clayey mantle: 15 to 38 inches

A horizon:

Hue—neutral or 10YR

Value—2

Chroma—0 or 1

Texture—clay loam

Bg horizon:

Hue—2.5Y or 5Y

Value—3 to 5

Chroma—1 or 2

Texture—silty clay, silty clay loam, or clay

Content of rock fragments—2 to 5 percent

2Bkg horizon:

Hue—2.5Y or 5Y

Value—4 or 5

Chroma—1 or 2

Texture—loam or clay loam

Content of rock fragments—3 to 8 percent

644—Boash clay loam

Composition

Boash and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 9.7 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Clearwater and similar soils
- Hamerly and similar soils
- Kratka and similar soils
- Newfolden and similar soils
- Vallers and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Borup Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Moderately rapid

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 2 percent

Taxonomic classification: Coarse-silty, mixed, superactive, frigid Typic Calciaquolls

Typical Pedon

Borup very fine sandy loam, 1,750 feet north and 700 feet west of the southeast corner of sec. 29, T. 158 N., R. 47 W.

Ap—0 to 8 inches; black (N 2/0) very fine sandy loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure; very friable; few very fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg1—8 to 14 inches; dark grayish brown (2.5Y 4/2) very fine sandy loam; few fine distinct yellowish brown (10YR 5/4) iron concentrations; weak very fine subangular blocky structure; very friable; few very fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear smooth boundary.

Bkg2—14 to 21 inches; grayish brown (2.5Y 5/2) loamy very fine sand; common fine prominent yellowish brown (10YR 5/6) iron concentrations; weak very fine subangular blocky structure; very friable; few very fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear smooth boundary.

Bkg3—21 to 26 inches; light brownish gray (2.5Y 6/2) silt loam; common fine distinct olive yellow (2.5Y 6/6) iron concentrations; weak fine subangular blocky structure; friable; few very fine roots; many medium carbonate coatings on faces of peds and in pores; strongly effervescent; slightly alkaline; clear smooth boundary.

Bkg4—26 to 36 inches; dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) silt loam; common

fine distinct light olive brown (2.5Y 5/6) iron concentrations; weak fine subangular blocky structure; friable; common fine carbonate coatings on faces of peds and in pores; strongly effervescent; slightly alkaline; clear wavy boundary.

Cg—36 to 60 inches; grayish brown (2.5Y 5/2), stratified silt loam and very fine sand; common fine distinct light olive brown (2.5Y 5/6) and common fine prominent dark brown (7.5YR 4/4) iron concentrations; weak medium platy soil fragments; friable; common fine carbonate coatings on faces of peds and in pores; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 15 inches

A horizon:

Hue—neutral or 10YR

Value—2

Chroma—0 or 1

Texture—very fine sandy loam

Bkg horizon:

Hue—2.5Y or 10YR

Value—4 to 6

Chroma—2

Texture—very fine sandy loam, loamy very fine sand, or silt loam

Cg horizon:

Hue—2.5Y

Value—4 to 6

Chroma—2 or 3

Texture—silt loam, very fine sandy loam, loam, or very fine sand

1299—Borup very fine sandy loam

Composition

Borup and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Very fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Glyndon and similar soils
- Augsburg and similar soils
- Rosewood and similar soils
- Colvin and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Cathro Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderately slow to moderately rapid; lower part—moderate or moderately slow
Landform: Lake plains
Parent material: Organic materials and till
Slope range: 0 to 1 percent
Taxonomic classification: Loamy, mixed, euic Terric Borosaprists

Typical Pedon

Cathro muck, 2,400 feet north and 2,400 feet west of the southeast corner of sec. 23, T. 157 N., R. 43 W.

Oa1—0 to 11 inches; black (10YR 2/1) muck; 30 percent fiber, 10 percent rubbed; weak fine granular structure; friable; many fine and medium roots; strongly acid; clear wavy boundary.

Oa2—11 to 25 inches; black (N 2/0) muck; 15 percent fiber, 5 percent rubbed; weak thin platy structure; friable; common fine roots; strongly acid; clear smooth boundary.

A—25 to 28 inches; black (N 2/0) mucky fine sandy loam; weak fine subangular blocky structure; friable; few fine roots; 2 percent gravel; neutral; abrupt wavy boundary.

Cg—28 to 60 inches; olive gray (5Y 5/2) fine sandy loam; common medium prominent light olive brown (2.5Y 5/6) iron concentrations and common fine faint light brownish gray (2.5Y 6/2) iron depletions; massive with medium blocky soil fragments; friable; few fine roots; common fine threads of carbonate; 7 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 16 to 42 inches
Thickness of the histic epipedon: 16 to 40 inches

Oa horizon:

Hue—neutral, 7.5YR, or 10YR
 Value—2 or 3
 Chroma—0 to 2
 Texture—muck

A horizon:

Hue—neutral, 2.5Y, or 10YR
 Value—2 to 4
 Chroma—0 or 1
 Texture—mucky fine sandy loam, mucky loam, clay loam, fine sandy loam, sandy loam, or loam
 Content of rock fragments—2 to 4 percent

Cg horizon:

Hue—10YR, 2.5Y, or 5Y
 Value—4 to 6
 Chroma—1 to 3
 Texture—fine sandy loam, sandy loam, loam, or clay loam
 Content of rock fragments—2 to 8 percent

544—Cathro muck

Composition

Cathro and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface

Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 16.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a mineral surface layer
- Hamre and similar soils
- Seelyeville and similar soils
- Soils that are ponded

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1807—Cathro muck, ponded

Composition

Cathro and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and till
Flooding: None
Seasonal high water table: 3.0 feet above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 20.4 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a mineral surface layer
- Berner and similar soils
- Hamre and similar soils
- Seelyeville and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Clearriver Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid
Landform: Beach ridges on lake plains
Parent material: Beach deposits
Slope range: 0 to 3 percent
Taxonomic classification: Mixed, frigid Aquic Udipsamments

Typical Pedon

Clearriver loamy fine sand, 200 feet south and 200 feet east of the northwest corner of sec. 7, T. 157 N., R. 43 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) loamy fine sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; few fine roots; slightly acid; abrupt smooth boundary.

E/Bt—9 to 14 inches; mixed, dark grayish brown (10YR 4/2) fine sand and dark brown (10YR 3/3) sandy clay loam; common medium distinct strong brown (7.5YR 4/6) iron concentrations; moderate fine and medium subangular blocky structure; friable; clay bridging between sand grains; 7 percent gravel; neutral; clear smooth boundary.

C1—14 to 25 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; 12 percent gravel; slightly effervescent; neutral; gradual wavy boundary.

C2—25 to 44 inches; light brownish gray (2.5Y 6/2) gravelly coarse sand; few common distinct light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; 21 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

C3—44 to 60 inches; light brownish gray (2.5Y 6/2) sand; few common distinct light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; 4

percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 14 to 30 inches

Thickness of the surface layer: 3 to 10 inches

A horizon:

Hue—10YR

Value—2 to 4

Chroma—1 or 2

Texture—loamy fine sand

E part of the E/Bt horizon:

Hue—10YR

Value—3 or 4

Chroma—2 to 4

Texture—fine sand or sand

Content of rock fragments—2 to 7 percent

Bt part of the E/Bt horizon:

Hue—7.5YR or 10YR

Value—3 or 4

Chroma—3 or 4

Texture—sandy loam, coarse sandy loam, sandy clay loam, or loamy sand

Content of rock fragments—5 to 7 percent

C horizon:

Hue—2.5Y or 10YR

Value—4 to 6

Chroma—2 to 4

Texture—fine sand, sand, coarse sand, or gravelly coarse sand

Content of rock fragments—4 to 30 percent

794—Clearriver loamy fine sand

Composition

Clearriver and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on beach plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Beach deposits

Flooding: None

Depth to the water table: 2.0 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 3.3 inches

Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Grygla and similar soils
- Corliss and similar soils
- Cormant and similar soils
- Northwood and similar soils
- Sahkahtay and similar soils
- Redby and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Clearwater Series

Depth class: Very deep

Drainage class: Poorly drained or very poorly drained

Permeability: Upper part—moderate to slow; lower part—slow

Landform: Lake plains

Parent material: Till

Slope range: 0 to 2 percent

Taxonomic classification: Fine, smectitic, frigid Typic Epiaquerts

Typical Pedon

Clearwater loam, 275 feet south and 2,350 feet west of the northeast corner of sec. 31, T. 156 N., R. 42 W.

Ap—0 to 8 inches; black (N 2/0) loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure parting to moderate very fine granular; friable; few fine roots; 4 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Bssg1—8 to 20 inches; dark grayish brown (2.5Y 4/2) silty clay; many fine distinct light olive brown (2.5Y 5/6) iron concentrations and many fine distinct dark gray (5Y 4/1) iron depletions; moderate fine angular blocky structure; firm; few

fine roots; few distinct intersecting slickensides on faces of pedes with a slant of less than 45 degrees above the horizontal; cracks $\frac{1}{4}$ inch to 3 inches wide and 2 to 4 feet apart filled with material from the A horizon; 4 percent gravel; strongly effervescent; slightly alkaline; gradual smooth boundary.

Bssg2—20 to 33 inches; dark grayish brown (2.5Y 4/2) clay; many fine distinct light olive brown (2.5Y 5/6) iron concentrations and many fine faint olive gray (5Y 4/2) iron depletions; moderate fine angular blocky structure; firm; common fine threads of carbonate; few distinct intersecting slickensides on faces of pedes with a slant of less than 60 degrees above the horizontal; cracks $\frac{1}{4}$ inch to 2 inches wide and 2 to 4 feet apart filled with material from the A horizon; 5 percent gravel; strongly effervescent; slightly alkaline; gradual smooth boundary.

Bg—33 to 60 inches; olive gray (5Y 4/2) clay; many fine and medium faint dark olive gray (5Y 3/2) and very dark gray (5Y 3/1) iron depletions and common fine and medium prominent light olive brown (2.5Y 5/6) iron concentrations; moderate fine angular blocky structure; very firm; common fine threads of carbonate; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 12 inches

Depth to carbonates: Less than 10 inches

A horizon:

Hue—neutral, 10YR, or 2.5Y

Value—2 or 3

Chroma—0 or 1

Texture—clay, loam, or mucky loam

Content of rock fragments—1 to 4 percent

Bssg and Bg horizons:

Hue—2.5Y or 5Y

Value—3 to 5

Chroma—1 or 2

Texture—silty clay, clay, or silty clay loam

Content of rock fragments—3 to 8 percent

641—Clearwater clay

Composition

Clearwater and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Clay

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 9.8 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Augsburg and similar soils
- Thiefriver and similar soils
- Newfolden and similar soils
- Wyandotte and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

642—Clearwater loam

Composition

Clearwater and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 9.6 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Wyandotte and similar soils
- Augsburg and similar soils
- Newfolden and similar soils
- Thiefriver and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

936—Clearwater-Reis complex**Composition**

Clearwater and similar soils: About 50 percent
Reis and similar soils: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Clearwater—flats and swales on lake plains; Reis—slight rises on lake plains
Slope: 0 to 2 percent

Component Description**Clearwater**

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.6 inches
Organic matter content: Moderate

Reis

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Wheatville and similar soils
- Glyndon and similar soils
- Augsburg and similar soils
- Newfolden and similar soils
- Espelie and similar soils
- Wyandotte and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1189—Clearwater mucky loam, depressional**Composition**

Clearwater and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Mucky loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 9.6 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Espelie and similar soils
- Wildwood and similar soils
- Reis and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Colvin Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Moderately slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 2 percent

Taxonomic classification: Fine-silty, mixed, superactive, frigid Typic Calciaquolls

Typical Pedon

Colvin silty clay loam, 450 feet south and 1,050 feet east of the northwest corner of sec. 25, T. 156 N., R. 49 W.

Ap—0 to 9 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; few very fine roots; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg1—9 to 14 inches; very dark gray (5Y 3/1) silty clay loam; weak medium subangular blocky structure; friable; few very fine roots; disseminated carbonates; violently effervescent; moderately alkaline; gradual wavy boundary.

Bkg2—14 to 29 inches; olive gray (5Y 4/2) silty clay loam; few fine prominent olive yellow (2.5Y 6/6) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg3—29 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) iron concentrations; weak fine

subangular blocky structure; friable; few fine roots; common fine threads of carbonate on faces of peds and in pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Cg—40 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) iron concentrations; massive with medium blocky and platy soil fragments; friable; common threads of carbonate on faces of peds and in pores; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches

A horizon:

Hue—10YR, 2.5Y, 5Y, or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay loam

Bkg horizon:

Hue—10YR, 2.5Y, or 5Y

Value—3 to 6

Chroma—1 or 2

Texture—silt loam or silty clay loam

Cg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—2

Texture—silt loam or silty clay loam

47—Colvin silty clay loam

Composition

Colvin and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 10.9 inches

Organic matter content: High

A typical soil series description with range in

characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Bearden and similar soils
- Fargo and similar soils
- Augsburg and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1964—Colvin-Fargo complex

Composition

Colvin and similar soils: About 50 percent
Fargo and similar soils: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Colvin—flats and slight rises on lake plains; Fargo—swales on lake plains
Slope: 0 to 2 percent

Component Description

Colvin

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.9 inches
Organic matter content: High

Fargo

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Seasonal high water table: At the surface to 1.5 feet below the surface
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Bearden and similar soils
- Hegne and similar soils
- Northcote and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Corliss Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Rapid or very rapid
Landform: Beach ridges on lake plains
Parent material: Beach deposits
Slope range: 1 to 6 percent
Taxonomic classification: Mixed, frigid Typic Udipsammments

Typical Pedon

Corliss loamy sand, 1 to 6 percent slopes, 2,200 feet north and 2,400 feet east of the southwest corner of sec. 11, T. 158 N., R. 40 W.

- Ap—0 to 7 inches; black (10YR 2/1) loamy sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; 1 percent gravel; slightly acid; abrupt smooth boundary.
- Bw—7 to 12 inches; brown (10YR 4/3) gravelly sand; single grain; loose; 15 percent gravel; 1 percent cobbles; neutral; clear smooth boundary.
- C1—12 to 34 inches; dark grayish brown (10YR 4/2) gravelly sand; single grain; loose; 15 percent gravel; 2 percent cobbles; slightly effervescent; slightly alkaline; clear wavy boundary.
- C2—34 to 50 inches; grayish brown (10YR 5/2) sand; single grain; loose; 12 percent gravel; 2 percent cobbles; slightly effervescent; slightly alkaline; gradual wavy boundary.
- C3—50 to 60 inches; grayish brown (10YR 5/2) gravelly sand; single grain; loose; 20 percent gravel; 3 percent cobbles; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 12 to 40 inches

Content of rock fragments: 10 to 35 percent

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loamy sand

Content of rock fragments—less than 2 percent

Bw horizon:

Hue—10YR

Value—4

Chroma—3 or 4

Texture—coarse sand, sand, loamy coarse sand, loamy sand, gravelly sand, or gravelly coarse sand

Content of rock fragments—2 to 20 percent gravel

C horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—gravelly coarse sand, gravelly sand, coarse sand, sand, or fine sand

Content of rock fragments—2 to 35 percent

721B—Corliss loamy sand, 1 to 6 percent slopes

Composition

Corliss and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Beach ridges

Position on the landform: Summits and backslopes

Slope: 1 to 6 percent

Component Description

Surface layer texture: Loamy sand

Depth class: Very deep (more than 60 inches)

Drainage class: Excessively drained

Dominant parent material: Beach deposits

Flooding: None

Depth to the water table: Greater than 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 3.0 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this

map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Sahkahtay and similar soils
- Syrene and similar soils
- Marquette and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Cormant Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Rapid

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 2 percent

Taxonomic classification: Mixed, frigid Mollic Psammaquents

Typical Pedon

Cormant loamy fine sand, 400 feet north and 600 feet west of the southeast corner of sec. 12, T. 158 N., R. 39 W.

A—0 to 8 inches; black (10YR 2/1) loamy fine sand, gray (10YR 5/1) dry; weak very fine subangular blocky structure; very friable; few very fine roots; neutral; abrupt smooth boundary.

Cg1—8 to 14 inches; grayish brown (2.5Y 5/2) fine sand; few fine prominent brownish yellow (10YR 6/6) iron concentrations; single grain; loose; few fine roots; neutral; gradual smooth boundary.

Cg2—14 to 34 inches; grayish brown (2.5Y 5/2) fine sand; common medium prominent yellowish brown (10YR 5/6) and few fine prominent dark yellowish brown (10YR 4/6) iron concentrations; single grain; loose; few fine roots; neutral; gradual smooth boundary.

Cg3—34 to 54 inches; light brownish gray (2.5Y 6/2) fine sand; common medium prominent yellowish brown (10YR 5/6) and few fine prominent dark yellowish brown (10YR 4/6) iron concentrations; single grain; loose; neutral; abrupt wavy boundary.

Cg4—54 to 60 inches; light olive gray (5Y 6/2) fine sand; few fine distinct light yellowish brown (2.5Y 6/4) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: More than 40 inches
Thickness of the surface layer: 5 to 9 inches

A horizon:

Hue—10YR
Value—2 or 3
Chroma—1
Texture—loamy fine sand

Cg horizon:

Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2
Texture—fine sand or sand

117—Cormant loamy fine sand

Composition

Cormant and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 5.0 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Redby and similar soils
- Grygla and similar soils
- Deerwood and similar soils
- Eckvoll and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Deerwood Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderate or moderately rapid; lower part—rapid
Landform: Lake plains
Parent material: Organic materials and glaciolacustrine deposits
Slope range: 0 to 1 percent
Taxonomic classification: Sandy, mixed, frigid Histic Humaquepts

Typical Pedon

Deerwood muck, 100 feet south and 100 feet west of the northeast corner of sec. 28, T. 157 N., R. 43 W.

Oa—0 to 11 inches; black (N 2/0) muck; 25 percent fiber, 10 percent rubbed; moderate fine granular structure; very friable; many very fine roots; neutral; abrupt smooth boundary.
A—11 to 15 inches; black (N 2/0) fine sandy loam; massive; friable; few fine roots; few thin sand lenses; 1 percent gravel; slightly effervescent; neutral; clear smooth boundary.
Cg—15 to 60 inches; light gray (2.5Y 7/2) fine sand; common fine faint light brownish gray (2.5Y 6/2) iron depletions and few fine distinct light yellowish brown (2.5Y 6/4) iron concentrations; single grain; loose; 10 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Less than 16 inches
Thickness of the histic epipedon: 8 to 16 inches

Oa horizon:

Hue—10YR or neutral
Value—2
Chroma—0 or 1
Texture—muck

A horizon:

Hue—5Y or neutral

Value—2 or 3
 Chroma—0 or 1
 Texture—fine sandy loam, loamy fine sand, or loamy sand
 Content of rock fragments—1 to 5 percent

Cg horizon:

Hue—2.5Y or 5Y
 Value—5 to 7
 Chroma—1 or 2
 Texture—fine sand, sand, or gravelly coarse sand
 Content of rock fragments—2 to 35 percent

547—Deerwood muck

Composition

Deerwood and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 6.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hangaard and similar soils
- Rosewood and similar soils
- Northwood and similar soils
- Markey and similar soils

Major Uses of the Unit

- Wildlife habitat
- For general and detailed information concerning

these uses, see Part II of this publication:

- Wildlife Habitat section

Dora Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderate or moderately rapid; lower part—very slow
Landform: Lake plains
Parent material: Organic materials and glaciolacustrine deposits or till
Slope range: 0 to 1 percent
Taxonomic classification: Clayey, smectitic, euic Terric Borosaprists

Typical Pedon

Dora muck, 600 feet south and 1,500 feet east of the northwest corner of sec. 12, T. 155 N., R. 42 W.

Oa1—0 to 23 inches; black (10YR 2/1) muck; 35 percent fiber, 5 percent rubbed; weak thin platy structure; very friable; many very fine and common fine and medium roots; strongly acid; gradual smooth boundary.

Oa2—23 to 31 inches; black (N 2/0) muck; 15 percent fiber, trace rubbed; weak thin platy structure; very friable; moderately acid; abrupt smooth boundary.

Cg1—31 to 36 inches; dark grayish brown (2.5Y 4/2) clay; common medium prominent strong brown (7.5YR 4/6) iron concentrations; massive with medium blocky soil fragments; firm; 2 percent gravel; slightly effervescent; neutral; abrupt wavy boundary.

Cg2—36 to 60 inches; light brownish gray (2.5Y 6/2) silty clay; common medium prominent strong brown (7.5YR 4/6) iron concentrations; massive with fine and medium blocky soil fragments; firm; many threads of carbonate; 2 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 to 42 inches
Thickness of the histic epipedon: 18 to 38 inches

Oa horizon:

Hue—7.5YR, 10YR, or neutral
 Value—2
 Chroma—0 or 1
 Texture—muck

Cg horizon:

Hue—10YR, 2.5Y, or 5Y
 Value—4 to 6

Chroma—1 or 2
 Texture—clay, silty clay, or silty clay loam
 Content of rock fragments—1 to 5 percent

550—Dora muck

Composition

Dora and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits or till
Flooding: None
Depth to the water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 18.3 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Soils that have a mineral surface layer
- Wildwood and similar soils
- Soils that are ponded
- Seelyeville and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1187—Dora muck, ponded

Composition

Dora and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits
Flooding: None
Seasonal high water table: At the surface to 2 feet above the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 16.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Wildwood and similar soils
- Seelyeville and similar soils
- Soils that have a mineral surface layer

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Eaglepoint Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Slow or very slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Very fine, smectitic, frigid
 Aeric Calciaquerts

Typical Pedon

Eaglepoint clay, in an area of Eaglepoint-Northcote complex, 1,684 feet north and 400 feet west of the southeast corner of sec. 3, T. 157 N., R. 49 W.

Ap—0 to 10 inches; black (5Y 2.5/1) clay, very dark

gray (5Y 3/1) dry; strong coarse and medium subangular blocky structure; very firm; many very fine roots; few fine and medium calcium carbonate threads and concretions on faces of peds; strongly effervescent; slightly alkaline; clear wavy boundary.

Bkss1—10 to 22 inches; olive gray (5Y 5/2) clay; moderate thin platy structure parting to strong very fine angular blocky; very firm; common very fine roots in peds and pores; many very fine tubular pores; few distinct intersecting slickensides on faces of peds with a slant of less than 45 degrees above the horizontal; cracks 1/4 inch to 3 inches wide and 2 to 4 feet apart filled with material from the A horizon; many carbonate coatings throughout; violently effervescent; moderately alkaline; gradual wavy boundary.

Bkss2—22 to 29 inches; olive gray (5Y 5/2) clay; few fine prominent light olive brown (2.5Y 5/4) iron concentrations; moderate fine prismatic structure parting to strong very fine angular blocky; very firm; common very fine roots in peds and pores; common very fine tubular pores; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks 1/4 inch to 2 inches wide and 2 to 4 feet apart filled with material from the A horizon; many carbonate coatings throughout; violently effervescent; moderately alkaline; gradual wavy boundary.

Bkg1—29 to 40 inches; dark grayish brown (2.5Y 4/2) clay; common fine prominent yellowish brown (10YR 5/6) iron concentrations; moderate fine prismatic structure parting to strong very fine angular blocky; very firm; few very fine roots in peds and pores; common very fine tubular pores; common carbonate coatings throughout; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bkg2—40 to 48 inches; dark grayish brown (2.5Y 4/2) clay; few fine prominent strong brown (7.5Y 5/6) and common fine prominent yellowish brown (10YR 5/6) iron concentrations; moderate fine prismatic structure parting to strong very fine angular blocky; very firm; common very fine tubular pores; common carbonate coatings throughout; strongly effervescent; moderately alkaline; clear wavy boundary.

3Cg—48 to 55 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine distinct yellowish brown (10YR 5/6) and many fine prominent strong brown (7.5YR 5/6) iron concentrations; moderate medium platy structure parting to moderate fine subangular blocky; firm; few very fine tubular

pores; common fine and medium soft masses of carbonate; strongly effervescent; moderately alkaline; clear wavy boundary.

Cg—55 to 82 inches; light olive brown (2.5Y 5/2) silty clay; common fine prominent reddish brown (5YR 4/4) and many fine prominent strong brown (7.5YR 5/6) iron concentrations; medium platy and fine angular blocky soil fragments; very firm; few fine and medium soft masses of carbonate; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 12 inches

A horizon:

Hue—10YR, 2.5Y, 5Y, or neutral

Value—1 to 3

Chroma—0 to 2

Texture—clay

Bkss and Bkg horizons:

Hue—2.5Y or 5Y

Value—3 to 5

Chroma—1 or 2

Texture—clay or silty clay

BCg horizon:

Hue—2.5Y or 5Y

Value—3 or 4

Chroma—1 or 2

Texture—silty clay or clay

Cg horizon:

Hue—2.5Y or 5Y

Value—4 or 5

Chroma—1 to 3

Texture—silty clay or clay

937—Eaglepoint-Northcote complex

Composition

Eaglepoint and similar soils: About 55 percent

Northcote and similar soils: About 40 percent

Inclusions: About 5 percent

Setting

Landform: Eaglepoint—flats and slight rises on lake plains; Northcote—swales on lake plains

Slope: 0 to 2 percent

Component Description

Eaglepoint

Surface layer texture: Clay

Depth class: Very deep (more than 60 inches)

Drainage class: Somewhat poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1.5 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.1 inches
Organic matter content: High

Northcote

Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.5 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Bearden and similar soils
- Colvin and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Eckvoll Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—rapid; lower part—moderate or moderately slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Loamy, mixed, superactive
 Aquic Arenic Eutroboralfs

Typical Pedon

Eckvoll loamy fine sand, 150 feet north and 2,500 feet east of the southwest corner of sec. 21, T. 155 N., R. 39 W.

Ap—0 to 8 inches; black (10YR 2/1) loamy fine sand,

dark gray (10YR 4/1) dry; weak medium subangular blocky structure; very friable; few fine roots; slightly acid; abrupt smooth boundary.
 E—8 to 28 inches; brown (10YR 5/3) fine sand, light gray (10YR 7/2) dry; common medium distinct yellowish brown (10YR 5/6) and few fine faint dark brown (10YR 4/3) iron concentrations; single grain; loose; few fine roots; neutral; clear wavy boundary.
 2Bt—28 to 33 inches; dark grayish brown (10YR 4/2) sandy clay loam; common fine distinct brown (7.5YR 4/4) iron concentrations and common medium faint dark grayish brown (2.5Y 4/2) iron depletions; moderate fine subangular blocky structure; friable; few fine roots; many distinct very dark gray (10YR 3/1), continuous clay films on faces of peds; 10 percent gravel; neutral; clear wavy boundary.
 2BC—33 to 60 inches; grayish brown (2.5Y 5/2) loam; many medium distinct light olive brown (2.5Y 5/6) and common medium prominent yellowish brown (10YR 5/8) iron concentrations; weak fine subangular blocky structure; friable; many threads of carbonate; 8 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 22 to 48 inches
Thickness of the argillic horizon: 4 to 8 inches
Thickness of the sandy mantle: 20 to 36 inches

A horizon:

Hue—10YR
 Value—2 or 3
 Chroma—1 or 2
 Texture—loamy fine sand

E horizon:

Hue—10YR or 2.5Y
 Value—3 to 6
 Chroma—2 or 3
 Texture—fine sand or sand
 Content of rock fragments—0 to 2 percent

2Bt horizon:

Hue—10YR, 2.5Y, or 5Y
 Value—3 to 6
 Chroma—2 to 4
 Texture—sandy clay loam or clay loam
 Content of rock fragments—2 to 10 percent

2BC horizon:

Hue—2.5Y
 Value—5 or 6
 Chroma—2
 Texture—loam or silt loam

Content of rock fragments—2 to 8 percent

565—Eckvoll loamy fine sand

Composition

Eckvoll and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 1.5 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Kratka and similar soils
- Smiley and similar soils
- Reiner and similar soils
- Flaming and similar soils
- Radium and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Enstrom Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—rapid; lower part—moderately slow or moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 3 percent

Taxonomic classification: Sandy over loamy, mixed, superactive, nonacid, frigid Aquic Udorthents

Typical Pedon

Enstrom loamy fine sand, 200 feet south and 1,700 feet east of the northwest corner of sec. 16, T. 158 N., R. 45 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) loamy fine sand, gray (10YR 5/1) dry; weak medium subangular blocky structure; very friable; few fine roots; neutral; abrupt smooth boundary.

Bw1—7 to 15 inches; brown (10YR 5/3) fine sand; common fine faint dark yellowish brown (10YR 4/4) and common medium distinct dark yellowish brown (10YR 4/6) iron concentrations; single grain; loose; neutral; gradual wavy boundary.

Bw2—15 to 25 inches; yellowish brown (10YR 5/4) fine sand; common fine distinct dark yellowish brown (10YR 4/6) iron concentrations; single grain; loose; neutral; clear wavy boundary.

2C—25 to 60 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent brownish yellow (10YR 6/6) and common medium prominent yellowish brown (10YR 5/8) iron concentrations; massive with weak fine subangular blocky soil fragments; friable; many soft masses of carbonates; 8 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 40 inches

Thickness of the sandy mantle: 25 to 40 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loamy fine sand

Bw horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—fine sand or sand

2C horizon:

Hue—2.5Y

Value—5 or 6

Chroma—2

Texture—loam or silt loam

Content of rock fragments—2 to 8 percent

145—Enstrom loamy fine sand**Composition**

Enstrom and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 8.5 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Grygla and similar soils
- Kratka and similar soils
- Poppleton and similar soils
- Foxhome and similar soils
- Mavie and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Espelie Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Upper part—moderately rapid; lower part—slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 2 percent

Taxonomic classification: Sandy over clayey, mixed over smectitic, frigid Typic Epiaquolls

Typical Pedon

Espelie fine sandy loam, 750 feet south and 1,600 feet east of the northwest corner of sec. 8, T. 156 N., R. 42 W.

Ap—0 to 10 inches; black (N 2/0) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few very fine roots; neutral; abrupt smooth boundary.

Bg1—10 to 15 inches; grayish brown (2.5Y 5/2) loamy fine sand; common medium prominent light olive brown (2.5Y 5/6) iron concentrations; weak fine subangular blocky structure; very friable; 4 percent gravel; neutral; clear wavy boundary.

Bg2—15 to 25 inches; light brownish gray (2.5Y 6/2) fine sand; common medium prominent olive yellow (2.5Y 6/6) iron concentrations and common fine faint grayish brown (2.5Y 5/2) iron depletions; single grain; loose; 2 percent gravel; neutral; gradual wavy boundary.

Bg3—25 to 34 inches; light brownish gray (2.5Y 6/2) sand; few fine distinct light olive brown (2.5Y 5/6) iron concentrations and common fine faint grayish brown (2.5Y 5/2) iron depletions; single grain; loose; 3 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

2Cg—34 to 60 inches; olive gray (5Y 4/2) clay; common medium prominent light olive brown (2.5Y 5/6) iron concentrations and common medium faint gray (5Y 5/1) iron depletions; massive with medium blocky soil fragments; firm; common fine threads of carbonate; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 17 to 40 inches

Thickness of the mollic epipedon: 8 to 16 inches

Thickness of the sandy mantle: 20 to 40 inches

A horizon:

Hue—neutral or 10YR

Value—2

Chroma—0 or 1

Texture—fine sandy loam

Bg horizon:

Hue—10YR or 2.5Y

Value—5 or 6

Chroma—1 or 2

Texture—fine sand, loamy sand, loamy fine sand, or sand

Content of rock fragments—2 to 5 percent

2Cg horizon:

- Hue—2.5Y or 5Y
- Value—4 or 5
- Chroma—1 or 2
- Texture—clay or silty clay
- Content of rock fragments—1 to 8 percent

645—Espelie fine sandy loam**Composition**

Espelie and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.2 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hilaire and similar soils
- Clearwater and similar soils
- Thiefriver and similar soils
- Wyandotte and similar soils
- Hamar and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Fargo Series

Depth class: Very deep
Drainage class: Poorly drained and very poorly drained
Permeability: Slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Fine, smectitic, frigid Typic Epiaquerts

Typical Pedon

Fargo silty clay, 0 to 2 percent slopes (fig. 9), 2,500 feet north and 1,500 feet west of the southeast corner of sec. 31, T. 155 N., R. 48 W.

- Ap—0 to 8 inches; black (N 2/0) silty clay, very dark gray (N 3/0) dry; moderate fine subangular blocky structure parting to weak very fine granular; friable; common very fine and fine roots; neutral; abrupt smooth boundary.
- A—8 to 11 inches; black (5Y 2.5/1) silty clay, very dark gray (5Y 3/1) dry; moderate fine subangular blocky structure; firm; common fine and very fine roots; slightly effervescent; neutral; clear wavy boundary.
- B_{ssg}—11 to 17 inches; dark gray (5Y 4/1) silty clay; moderate coarse prismatic structure parting to moderate fine angular blocky; firm; few fine roots; few distinct intersecting slickensides on faces of pedes with a slant of less than 45 degrees above the horizontal; cracks 1/4 inch to 3 inches wide and 2 to 4 feet apart filled with material from the A horizon; slightly effervescent; neutral; clear wavy boundary.
- B_{kssg}—17 to 30 inches; olive gray (5Y 5/2) silty clay; moderate coarse prismatic structure parting to moderate fine angular blocky; firm; few fine roots; few distinct intersecting slickensides on faces of pedes with a slant of less than 60 degrees above the horizontal; cracks 1/4 inch to 2 inches wide and 2 to 4 feet apart filled with material from the A horizon; common fine threads of carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary.
- B_{kg}—30 to 43 inches; olive gray (5Y 5/2) silty clay; weak coarse prismatic structure parting to weak very fine subangular blocky; firm; few fine roots; many fine threads of carbonate; violently effervescent; moderately alkaline; clear smooth boundary.
- C_g—43 to 60 inches; dark grayish brown (2.5Y 4/2) silty clay; many medium distinct light olive brown

(2.5Y 5/4) and common fine and medium prominent strong brown (7.5YR 5/6) iron concentrations; massive with medium platy and blocky soil fragments; firm; common fine threads of carbonate; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 11 to 42 inches

Thickness of the mollic epipedon: 8 to 20 inches

Ap or A horizon:

Hue—10YR, 2.5Y, 5Y, or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay

Bssg horizon:

Hue—10YR, 2.5Y, or 5Y

Value—2 to 4

Chroma—1 or 2

Texture—silty clay or clay

Bkssg and Bkg horizons:

Hue—10YR, 2.5Y, or 5Y

Value—3 to 6

Chroma—1 or 2

Texture—silty clay or clay

Cg horizon:

Hue—2.5Y or 5Y

Value—3 to 5

Chroma—1 or 2

Texture—silty clay, clay, or silty clay loam

57A—Fargo silty clay, 0 to 2 percent slopes

Composition

Fargo and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

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

Available water capacity to 60 inches or root-limiting layer: About 9.4 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Colvin and similar soils
- Hegne and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1871—Fargo silty clay, swales

Composition

Fargo and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Swales and depressions on lake plains

Slope: 0 to 1 percent

Component Description

Surface layer texture: Silty clay

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: Rare

Seasonal high water table: 0.5 foot above to 1.0 foot below the surface

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 9.4 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Wahpeton and similar soils

- Colvin and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Flaming Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Rapid

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 3 percent

Taxonomic classification: Sandy, mixed Aquic Haploborolls

Typical Pedon

Flaming loamy fine sand, 150 feet north and 1,000 feet east of the southwest corner of sec. 33, T. 155 N., R. 47 W.

Ap—0 to 9 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; very friable; few fine roots; neutral; abrupt smooth boundary.

A—9 to 15 inches; very dark gray (10YR 3/1) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; very friable; few fine roots; slightly acid; clear wavy boundary.

Bw—15 to 29 inches; brown (10YR 4/3) fine sand; single grain; loose; few fine roots; neutral; clear wavy boundary.

C1—29 to 38 inches; light yellowish brown (2.5Y 6/4) fine sand; many medium faint olive yellow (2.5Y 6/6) iron concentrations and common fine faint light brownish gray (2.5Y 6/2) iron depletions; single grain; loose; slightly effervescent; slightly alkaline; clear wavy boundary.

C2—38 to 60 inches; grayish brown (2.5Y 5/2) fine sand; common medium prominent olive yellow (2.5Y 6/6) and few fine distinct yellowish brown (10YR 5/6) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to more than 60 inches

Thickness of the mollic epipedon: 10 to 16 inches

Ap or A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loamy fine sand

Bw horizon:

Hue—10YR

Value—3 to 5

Chroma—2 to 4

Texture—fine sand, loamy fine sand, or sand

C horizon:

Hue—2.5Y

Value—5 or 6

Chroma—2 to 4

Texture—fine sand

66—Flaming loamy fine sand

Composition

Flaming and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 5.4 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Radium and similar soils
- Grimstad and similar soils
- Rosewood and similar soils
- Hamar and similar soils
- Poppleton and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1006—Fluvaquents-Haploborolls complex, 0 to 30 percent slopes, flooded

Composition

Fluvaquents and similar soils: About 45 percent
Haploborolls and similar soils: About 45 percent
Inclusions: About 10 percent

Setting

Landform: Fluvaquents—flats and swales on flood plains; Haploborolls—backslopes and shoulders on flood plains

Slope: Fluvaquents—0 to 2 percent; Haploborolls—2 to 30 percent

Component Description

Fluvaquents

Surface layer texture: Very fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Alluvium

Flooding: Frequent

Seasonal high water table: At the surface to 3 feet below the surface

Available water capacity to 60 inches or root-limiting layer: About 10.4 inches

Organic matter content: High

Haploborolls

Surface layer texture: Clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: Rare

Depth to the water table: 2.5 to 5.0 feet

Available water capacity to 60 inches or root-limiting layer: About 10.5 inches

Organic matter content: Moderate

Inclusions

- Soils that have steeper slopes
- Dominantly sandy soils
- Dominantly clayey soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Foldahl Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Upper part—rapid; lower part—moderately slow or moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 3 percent

Taxonomic classification: Sandy over loamy, mixed, superactive Aquic Haploborolls

Typical Pedon

Foldahl loamy fine sand, 2,500 feet south and 750 feet east of the northwest corner of sec. 12, T. 157 N., R. 46 W.

Ap—0 to 9 inches; black (10YR 2/1) loamy fine sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; few fine roots; slightly acid; abrupt smooth boundary.

A—9 to 13 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; single grain; loose; few fine roots; slightly acid; clear smooth boundary.

Bw1—13 to 23 inches; brown (10YR 4/3) sand; single grain; loose; few fine roots; neutral; clear smooth boundary.

Bw2—23 to 33 inches; dark yellowish brown (10YR 4/4) sand; few medium distinct dark brown (7.5YR 4/4) and common fine distinct yellowish brown (10YR 5/6) iron concentrations; single grain; loose; neutral; clear smooth boundary.

2C—33 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium distinct olive yellow (2.5Y 6/6) and common medium distinct light olive brown (2.5Y 5/6) iron concentrations; massive with medium blocky soil fragments; friable; common fine soft masses of carbonates; 8 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 21 to 32 inches

Thickness of the mollic epipedon: 10 to 16 inches

Thickness of the sandy mantle: 20 to 40 inches

Ap or A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2
 Texture—loamy fine sand or loamy sand
 Content of rock fragments—0 to 5 percent

Bw horizon:

Hue—10YR
 Value—3 or 4
 Chroma—2 to 4
 Texture—sand or fine sand
 Content of rock fragments—0 to 5 percent

2C horizon:

Hue—2.5Y or 10YR
 Value—5 to 7
 Chroma—2 to 4
 Texture—loam
 Content of rock fragments—5 to 10 percent

426—Foldahl loamy fine sand**Composition**

Foldahl and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.9 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Strathcona and similar soils
- Vallers and similar soils
- Grimstad and similar soils
- Flaming and similar soils

Major Uses of the Unit

- Cropland

- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Foxhome Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderately rapid; next part—rapid; lower part—moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Sandy-skeletal over loamy, mixed, superactive Aquic Haploborolls

Typical Pedon

Foxhome sandy loam, 200 feet south and 2,200 feet east of the northwest corner of sec. 12, T. 154 N., R. 45 W.

- Ap—0 to 8 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few very fine roots; slightly alkaline; abrupt smooth boundary.
- Bw1—8 to 14 inches; dark brown (10YR 3/3) loamy sand; weak fine subangular blocky structure; very friable; few very fine roots; 12 percent gravel; neutral; clear smooth boundary.
- 2Bw2—14 to 20 inches; brown (10YR 4/3) very gravelly coarse sand; single grain; loose; 55 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.
- 2Bw3—20 to 26 inches; yellowish brown (10YR 5/4) very gravelly coarse sand; common fine distinct dark grayish brown (10YR 4/2) iron depletions and few fine faint light yellowish brown (2.5Y 6/4) iron concentrations; single grain; loose; 65 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.
- 3BC—26 to 60 inches; grayish brown (2.5Y 5/2) loam; common medium distinct light olive brown (2.5Y 5/6) iron concentrations; weak medium subangular blocky structure; friable; few medium soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 11 to 16 inches
Thickness of the mollic epipedon: 7 to 12 inches

Thickness of the sandy mantle: 15 to 38 inches

A horizon:

Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—sandy loam
Content of rock fragments—0 to 5 percent

Bw horizon:

Hue—10YR
Value—3 or 4
Chroma—2 or 3
Texture—gravelly loamy sand, gravelly sandy loam, or loamy sand
Content of rock fragments—10 to 20 percent

2Bw horizon:

Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—very gravelly coarse sand, very gravelly loamy sand, or very gravelly sand
Content of rock fragments—35 to 65 percent

3BC horizon:

Hue—2.5Y
Value—5 or 6
Chroma—2 or 3
Texture—loam or silt loam
Content of rock fragments—1 to 10 percent

65—Foxhome sandy loam

Composition

Foxhome and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.9 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in

this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Mavie and similar soils
- Roliss and similar soils
- Foldahl and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Garnes Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Fine-loamy, mixed, superactive Aquic Eutroboralfs

Typical Pedon

Garnes fine sandy loam, 200 feet south and 1,400 feet east of the northwest corner of sec. 30, T. 158 N., R. 41 W.

A—0 to 4 inches; black (10YR 2/1) fine sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

E—4 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; neutral; abrupt smooth boundary.

Bt—10 to 17 inches; brown (10YR 4/3) clay loam; few medium faint dark grayish brown (10YR 4/2) iron depletions; moderate fine and medium subangular blocky structure; friable; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; 2 percent gravel; neutral; clear wavy boundary.

Bk—17 to 26 inches; grayish brown (2.5Y 5/2) loam; few fine faint dark grayish brown (2.5Y 4/2) iron depletions; weak medium subangular blocky structure; very friable; common fine carbonate

coatings on faces of peds and in pores; 3 percent gravel; strongly effervescent; slightly alkaline; gradual wavy boundary.

C—26 to 60 inches; light olive brown (2.5Y 5/4) loam; few medium distinct dark grayish brown (2.5Y 4/2) iron depletions; massive with fine and medium blocky soil fragments; very friable; many fine carbonate coatings on faces of peds and in pores; 8 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 13 to 17 inches

Thickness of the surface layer: 4 to 6 inches

Thickness of the sandy mantle: 8 to 18 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—fine sandy loam

E horizon:

Hue—10YR

Value—4

Chroma—2 or 3

Texture—fine sandy loam or loamy fine sand

Bt horizon:

Hue—10YR

Value—4

Chroma—2 or 3

Texture—clay loam or sandy clay loam

Content of rock fragments—2 to 5 percent

Bk and C horizons:

Hue—2.5Y

Value—5 to 7

Chroma—2 to 4

Texture—loam

Content of rock fragments—3 to 8 percent

77—Garnes fine sandy loam

Composition

Garnes and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 10.0 inches

Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Smiley and similar soils
- Grygla and similar soils
- Linveltdt and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Glyndon Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Upper part—moderate; lower part—moderately rapid

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 6 percent

Taxonomic classification: Coarse-silty, mixed, superactive, frigid Aeric Calciaquolls

Typical Pedon

Glyndon very fine sandy loam, 0 to 2 percent slopes, 1,000 feet north and 100 feet east of the southwest corner of sec. 22, T. 158 N., R. 47 W.

Ap—0 to 9 inches; black (10YR 2/1) very fine sandy loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; very friable; few fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

- Bk1—9 to 18 inches; dark gray (10YR 4/1) loamy very fine sand; weak fine subangular blocky structure; very friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear smooth boundary.
- Bk2—18 to 23 inches; dark grayish brown (10YR 4/2) loamy very fine sand; weak fine subangular blocky structure; very friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear smooth boundary.
- C1—23 to 35 inches; light yellowish brown (2.5Y 6/4) loamy very fine sand; few fine faint olive yellow (2.5Y 6/6) iron concentrations; massive; very friable; strongly effervescent; slightly alkaline; clear smooth boundary.
- C2—35 to 60 inches; light brownish gray (2.5Y 6/2) loamy very fine sand; many medium distinct olive yellow (2.5Y 6/8) iron concentrations and many medium faint light gray (2.5Y 7/2) iron depletions; massive; very friable; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 11 inches

A horizon:

Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—very fine sandy loam

Bk horizon:

Hue—10YR or 2.5Y
Value—3 to 6
Chroma—1 to 3
Texture—loamy very fine sand, very fine sandy loam, loam, or silt loam

C horizon:

Hue—2.5Y
Value—4 to 7
Chroma—2 to 4
Texture—loamy very fine sand, very fine sand, very fine sandy loam, silt loam, or loam

1304A—Glyndon very fine sandy loam, 0 to 2 percent slopes

Composition

Glyndon and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Very fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Borup and similar soils
- Rosewood and similar soils
- Wheatville and similar soils
- Ulen and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1304B—Glyndon very fine sandy loam, 2 to 6 percent slopes

Composition

Glyndon and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Lake plains
Position on the landform: Backslopes
Slope: 2 to 6 percent

Component Description

Surface layer texture: Very fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Borup and similar soils
- Lamoure and similar soils
- Ulen and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Grimstad Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Upper part—moderately rapid or rapid;
lower part—moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 3 percent

Taxonomic classification: Sandy over loamy, mixed,
superactive, frigid Aeric Calciaquolls

Typical Pedon

Grimstad fine sandy loam, 1,850 feet north and 500 feet east of the southwest corner of sec. 36, T. 155 N., R. 46 W.

Ap—0 to 10 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk—10 to 17 inches; dark gray (10YR 4/1) loamy fine sand; weak fine subangular blocky structure; very friable; few fine roots; few very dark gray (10YR 3/1) organic coatings in root channels; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

C1—17 to 29 inches; light yellowish brown (2.5Y 6/4) fine sand; few fine and common medium faint light brownish gray (2.5Y 6/2) iron depletions and common fine faint olive yellow (2.5Y 6/6) iron concentrations; single grain; loose; 1 percent gravel; slightly effervescent; slightly alkaline; gradual smooth boundary.

2C2—29 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium faint light gray (2.5Y 7/2) iron depletions and common fine prominent olive yellow (2.5Y 6/8) and many medium prominent light olive brown (2.5Y 5/6) iron concentrations; massive with fine blocky soil fragments; friable; common fine irregular soft masses of carbonates; 8 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 14 inches

Thickness of the sandy mantle: 20 to 40 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—fine sandy loam

Content of rock fragments—0 to 1 percent

Bk horizon:

Hue—10YR or 2.5Y

Value—4 or 5

Chroma—1 or 2

Texture—loamy sand, loamy fine sand, fine sandy loam, or very fine sandy loam

Content of rock fragments—0 to 1 percent

C horizon:

Hue—10YR or 2.5Y

Value—5 or 6

Chroma—2 to 4

Texture—sand or fine sand

Content of rock fragments—0 to 1 percent

2C horizon:

Hue—10YR or 2.5Y

Value—5 or 6

Chroma—2 to 4

Texture—fine sandy loam, loam, or silt loam

Content of rock fragments—1 to 8 percent

59—Grimstad fine sandy loam

Composition

Grimstad and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 8.3 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Vallers and similar soils
- Rosewood and similar soils
- Kratka and similar soils
- Ulen and similar soils
- Foldahl and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Grygla Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Upper part—rapid; lower part—moderately slow or moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 2 percent

Taxonomic classification: Sandy over loamy, mixed, superactive, nonacid, frigid Mollic Endoaquents

Typical Pedon

Grygla loamy fine sand, 200 feet south and 2,150 feet west of the northeast corner of sec. 25, T. 158 N., R. 39 W.

Ap—0 to 7 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; very friable; few very fine roots; neutral; abrupt smooth boundary.

Bg1—7 to 18 inches; light brownish gray (2.5Y 6/2)

fine sand; few fine distinct olive yellow (2.5Y 6/6) and many fine faint light yellowish brown (2.5Y 6/4) iron concentrations; single grain; loose; neutral; gradual wavy boundary.

Bg2—18 to 33 inches; grayish brown (2.5Y 5/2) fine sand; many medium distinct light olive brown (2.5Y 5/6) and few fine prominent yellowish red (5YR 5/8) iron concentrations; single grain; loose; neutral; clear wavy boundary.

2Bg3—33 to 60 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent yellowish brown (10YR 5/8) iron concentrations; weak very fine and medium subangular blocky structure; firm; common fine irregular soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 40 inches

Thickness of the surface layer: 5 to 8 inches

Thickness of the sandy mantle: 20 to 40 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loamy fine sand

Bg horizon:

Hue—2.5Y or 10YR

Value—5 or 6

Chroma—2

Texture—fine sand, sand, or loamy fine sand

Content of rock fragments—0 to 3 percent

2Bg horizon:

Hue—2.5Y

Value—4 to 6

Chroma—2

Texture—loam or silt loam

Content of rock fragments—1 to 5 percent

482—Grygla loamy fine sand

Composition

Grygla and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Loamy fine sand

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 8.1 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Berner and similar soils
- Eckvoll and similar soils
- Smiley and similar soils
- Northwood and similar soils
- Strathcona and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Hamar Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Rapid

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 2 percent

Taxonomic classification: Sandy, mixed, frigid Typic Endoaquolls

Typical Pedon

Hamar loamy fine sand, 1,700 feet north and 400 feet east of the southwest corner of sec. 14, T. 157 N., R. 46 W.

Ap—0 to 7 inches; black (10YR 2/1) loamy fine sand, very dark grayish brown (2.5Y 3/2) dry; weak fine granular structure; very friable; few fine roots; slightly alkaline; abrupt smooth boundary.

AC—7 to 20 inches; very dark brown (10YR 2/2)

loamy fine sand, very dark gray (10YR 3/1) dry; single grain; loose; few fine roots; neutral; clear wavy boundary.

Cg1—20 to 31 inches; dark grayish brown (2.5Y 4/2) fine sand; few fine distinct olive brown (2.5Y 4/4) iron concentrations; single grain; loose; slightly alkaline; clear wavy boundary.

Ab—31 to 33 inches; very dark grayish brown (10YR 3/2) fine sand; single grain; loose; neutral; clear wavy boundary.

Cg2—33 to 56 inches; grayish brown (2.5Y 5/2) fine sand; common fine faint dark grayish brown (2.5Y 4/2) iron depletions; single grain; loose; slightly alkaline; clear wavy boundary.

Cg3—56 to 60 inches; olive gray (5Y 5/2) fine sand; few fine distinct light yellowish brown (2.5Y 6/4) iron concentrations; single grain; loose; 1 percent gravel; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 11 to 20 inches

A horizon:

Hue—10YR

Value—2

Chroma—1

Texture—loamy fine sand

AC horizon:

Hue—10YR

Value—2

Chroma—2

Texture—loamy fine sand

Cg horizons:

Hue—2.5Y or 5Y

Value—4 or 5

Chroma—2

Texture—fine sand

Content of rock fragments—0 to 1 percent

Ab horizon:

Hue—10YR

Value—3

Chroma—2

Texture—fine sand

372—Hamar loamy fine sand

Composition

Hamar and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Loamy fine sand

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

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

Available water capacity to 60 inches or root-limiting layer: About 5.0 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Flaming and similar soils
- Deerwood and similar soils
- Northwood and similar soils
- Syrene and similar soils
- Kratka and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Hamerly Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderate

Landform: Lake plains

Parent material: Till

Slope range: 0 to 3 percent

Taxonomic classification: Fine-loamy, mixed, superactive, frigid Aeric Calciaquolls

Typical Pedon

Hamerly loam, 0 to 3 percent slopes, 1,400 feet south and 1,850 feet east of the northwest corner of sec. 17, T. 156 N., R. 45 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark

gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; 1 percent gravel; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—9 to 16 inches; grayish brown (2.5Y 5/2) loam; weak medium subangular blocky structure; very friable; few fine roots; disseminated carbonates; 1 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—16 to 24 inches; light yellowish brown (2.5Y 6/4) loam; weak medium subangular blocky structure; friable; common fine masses of carbonates; 3 percent gravel; strongly effervescent; slightly alkaline; gradual wavy boundary.

C—24 to 60 inches; light yellowish brown (2.5Y 6/4) loam; common fine distinct light brownish gray (10YR 6/2) iron depletions and common medium faint light olive brown (2.5Y 5/4) iron concentrations; massive with medium blocky soil fragments; friable; common fine masses of carbonates; 3 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 10 inches

A horizon:

Hue—10YR or 2.5Y

Value—2

Chroma—1 or 2

Texture—loam

Content of rock fragments—0 to 3 percent

Bk horizon:

Hue—10YR or 2.5Y

Value—3 to 6

Chroma—1 to 4

Texture—loam

Content of rock fragments—1 to 3 percent

C horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—2 to 4

Texture—loam

Content of rock fragments—1 to 5 percent

184A—Hamerly loam, 0 to 3 percent slopes

Composition

Hamerly and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 1.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 10.4 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Roliss and similar soils
- Grimstad and similar soils
- Strathcona and similar soils
- Foxhome and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Hamre Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Moderately slow or moderate

Landform: Lake plains

Parent material: Organic materials and till

Slope range: 0 to 1 percent

Taxonomic classification: Fine-loamy, mixed, superactive, nonacid, frigid Histic Humaquepts

Typical Pedon

Hamre muck, 2,500 feet north and 1,350 feet west of the southeast corner of sec. 23, T. 157 N., R. 43 W.

Oa—0 to 9 inches; black (N 2/0) muck; 10 percent fiber, 3 percent rubbed; moderate fine granular

structure; very friable; many fine and medium roots; moderately acid; clear smooth boundary.
 A—9 to 14 inches; black (N 2/0) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine and medium roots; 2 percent gravel; neutral; clear smooth boundary.
 Bg1—14 to 29 inches; olive gray (5Y 5/2) loam; common fine prominent light olive brown (2.5Y 5/6) and few medium prominent dark yellowish brown (10YR 4/6) iron concentrations; weak fine subangular blocky structure; friable; common fine roots; common fine threads of carbonate; 3 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.
 Bg2—29 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium distinct light yellowish brown (2.5Y 6/4) and common fine and medium prominent light olive brown (2.5Y 5/6) iron concentrations; weak fine subangular blocky structure; friable; few fine roots; disseminated carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 12 to 20 inches

Thickness of the histic epipedon: 8 to 16 inches

Oa horizon:

Hue—10YR, 2.5Y, 5Y, or neutral

Value—2 or 3

Chroma—0 or 1

Texture—muck

A horizon:

Hue—10YR, 2.5Y, 5Y, or neutral

Value—2 or 3

Chroma—0 to 2

Texture—loam, clay loam, or fine sandy loam

Content of rock fragments—0 to 2 percent

Bg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—1 to 3

Texture—loam or clay loam

Content of rock fragments—1 to 5 percent

1878—Hamre muck

Composition

Hamre and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains

Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Organic materials and till

Flooding: None

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

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 12.9 inches

Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Smiley and similar soils
- Strathcona and similar soils
- Vallers and similar soils
- Cathro and similar soils
- Soils that are ponded
- Northwood and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1804—Hamre muck, ponded

Composition

Hamre and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains

Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Organic materials and till

Flooding: None

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

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 12.9 inches

Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Cathro and similar soils
- Soils that have a mineral surface layer
- Northwood and similar soils
- Berner and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Hangaard Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Upper part—rapid; lower part—very rapid

Landform: Beach deposits on lake plains

Parent material: Beach deposits

Slope range: 0 to 2 percent

Taxonomic classification: Sandy, mixed, frigid Typic Endoaquolls

Typical Pedon

Hangaard sandy loam, 1,600 feet north and 100 feet east of the southwest corner of sec. 6, T. 158 N., R. 39 W.

Ap—0 to 8 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; few very fine roots; 2 percent gravel; neutral; abrupt smooth boundary.

Ag—8 to 14 inches; very dark grayish brown (2.5Y 3/2) loamy sand; weak fine granular structure; very friable; few very fine roots; 10 percent gravel; neutral; clear smooth boundary.

Cg1—14 to 20 inches; grayish brown (2.5Y 5/2)

gravelly coarse sand; common fine distinct yellowish brown (10YR 5/4) iron concentrations; single grain; loose; 20 percent gravel; strongly effervescent; slightly alkaline; clear smooth boundary.

Cg2—20 to 30 inches; light brownish gray (2.5Y 6/2) gravelly coarse sand; common fine prominent yellowish brown (10YR 5/6) iron concentrations; single grain; loose; 20 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

Cg3—30 to 38 inches; light brownish gray (2.5Y 6/2) sand; common fine distinct brown (10YR 5/3) iron concentrations; single grain; loose; 5 percent gravel; strongly effervescent; slightly alkaline; clear smooth boundary.

Cg4—38 to 60 inches; light brownish gray (2.5Y 6/2) gravelly coarse sand; common fine distinct yellowish brown (10YR 5/4) iron concentrations; single grain; loose; 25 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 14 to 30 inches

Thickness of the mollic epipedon: 7 to 16 inches

Content of rock fragments: Averages 10 to 35 percent in the 10- to 40-inch control section

Ap horizon:

Hue—10YR or neutral

Value—2

Chroma—0 or 1

Texture—sandy loam

Content of rock fragments—0 to 5 percent

Ag horizon:

Hue—10YR or 2.5Y

Value—3

Chroma—1 or 2

Texture—loamy sand, sandy loam, or fine sandy loam

Content of rock fragments—0 to 10 percent

Cg horizon:

Hue—2.5Y

Value—5 or 6

Chroma—2

Texture—gravelly coarse sand, coarse sand, gravelly sand, very gravelly coarse sand, or stratified sand or fine sand

Content of rock fragments—5 to 50 percent

111—Hangaard sandy loam

Composition

Hangaard and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on beach plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Beach deposits

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 2.9 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Radium and similar soils
- Flaming and similar soils
- Deerwood and similar soils
- Mavie and similar soils
- Kratka and similar soils
- Sahkahtay and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Haug Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Moderate or moderately rapid

Landform: Lake plains

Parent material: Organic materials and till

Slope range: 0 to 1 percent

Taxonomic classification: Coarse-loamy, mixed, calcareous, frigid Histic Humaquepts

Typical Pedon

Haug muck, 2,100 feet south and 1,000 feet west of the northeast corner of sec. 35, T. 158 N., R. 45 W.

Oa—0 to 8 inches; black (N 2/0) muck; 20 percent fiber, trace rubbed; weak very fine granular structure; very friable; slightly alkaline; clear smooth boundary.

A—8 to 17 inches; black (N 2/0) loam; weak fine granular structure; friable; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg1—17 to 24 inches; light brownish gray (2.5Y 6/2) loam; common fine distinct light olive brown (2.5Y 5/6) iron concentrations; weak very fine subangular blocky structure; friable; 2 percent gravel; many fine masses of carbonates; strongly effervescent; moderately alkaline; clear smooth boundary.

Bkg2—24 to 35 inches; light brownish gray (2.5Y 6/2) loam; many fine distinct light olive brown (2.5Y 5/6) iron concentrations; weak very fine subangular blocky structure; friable; 2 percent gravel; many fine masses of carbonates; strongly effervescent; moderately alkaline; clear smooth boundary.

Bg1—35 to 44 inches; light gray (2.5Y 7/2) loam; many fine prominent yellowish brown (10YR 5/6) iron concentrations; weak very fine subangular blocky structure; friable; 3 percent gravel; common fine masses of carbonates; strongly effervescent; slightly alkaline; gradual smooth boundary.

Bg2—44 to 60 inches; light gray (2.5Y 7/2) loam; many medium prominent yellowish brown (10YR 5/6) iron concentrations; weak very fine subangular blocky structure; friable; 3 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 8 to 11 inches

Thickness of the histic epipedon: 8 to 16 inches

Oa horizon:

Hue—neutral

Value—2

Chroma—0

Texture—muck

A horizon:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 or 1

Texture—loam or sandy loam

Content of rock fragments—0 to 8 percent

Bkg and Bg horizons:

Hue—2.5Y or 5Y

Value—4 to 7

Chroma—1 or 2

Texture—loam or sandy loam

Content of rock fragments—2 to 12 percent

187—Haug muck

Composition

Haug and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains

Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Organic materials and till

Flooding: None

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

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 11.9 inches

Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Percy and similar soils
- Cathro and similar soils
- Strathcona and similar soils
- Other soils that are ponded
- Northwood and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Hegne Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 2 percent

Taxonomic classification: Fine, smectitic, frigid Typic
Calciaquerts

Typical Pedon

Hegne silty clay, in an area of Hegne-Fargo complex, 600 feet south and 2,100 feet east of the northwest corner of sec. 22, T. 157 N., R. 49 W.

Apk—0 to 10 inches; black (N 2/0) silty clay, very dark gray (N 3/0) dry; common fine distinct olive gray (5Y 4/2) iron depletions; strong fine and medium subangular blocky structure; firm; few fine and medium roots; many fine soft masses of carbonates; slightly effervescent; slightly alkaline; clear wavy boundary.

Bkssg1—10 to 18 inches; about 60 percent olive gray (5Y 4/2) and 40 percent dark gray (5Y 6/1) silty clay, light gray (5Y 6/1) and gray (5Y 5/1) dry; moderate medium subangular blocky structure; firm; few fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 45 degrees above the horizontal; cracks $\frac{1}{4}$ inch to 3 inches wide and 2 to 4 feet apart filled with material from the A horizon; many fine soft masses of carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bkssg2—18 to 34 inches; olive gray (5Y 5/2) silty clay, light olive gray (5Y 6/2) dry; common fine faint dark gray (5Y 4/1) iron depletions; moderate fine and medium subangular blocky structure; firm; few very fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks $\frac{1}{4}$ inch to 2 inches wide and 2 to 4 feet apart filled with material from the A horizon; many fine soft masses of carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bg—34 to 50 inches; olive gray (5Y 4/2) silty clay; common medium distinct light olive brown (2.5YR 5/4) iron concentrations; weak fine and medium subangular blocky structure; friable; few fine soft masses of carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Cg—50 to 60 inches; olive gray (5Y 5/2) silty clay; common medium distinct gray (5Y 5/1) iron depletions and common medium prominent strong brown (7.5YR 4/6) and fine reddish yellow

(7.5YR 6/6) iron concentrations; weak fine and medium subangular blocky soil fragments parting to weak thin platy; firm; few medium carbonate coatings on faces of peds; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches

Apk horizon:

Hue—10YR, 2.5Y, or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay

Bkssg horizon:

Hue—5Y, 2.5Y, or 10YR

Value—4 to 6

Chroma—1 or 2

Texture—silty clay or clay

Bg horizon:

Hue—5Y or 2.5Y

Value—3 to 6

Chroma—1 or 2

Texture—clay or silty clay

Cg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—1 or 2

Texture—silty clay or clay

935—Hegne-Fargo complex

Composition

Hegne and similar soils: About 50 percent

Fargo and similar soils: About 40 percent

Inclusions: About 10 percent

Setting

Landform: Hegne—flats and slight rises on lake plains; Fargo—swales on lake plains

Slope: 0 to 2 percent

Component Description

Hegne

Surface layer texture: Silty clay

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 8.0 inches

Organic matter content: High

Fargo

Surface layer texture: Silty clay

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

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

Available water capacity to 60 inches or root-limiting layer: About 9.5 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Bearden and similar soils
- Colvin and similar soils
- Northcote and similar soils
- Eaglepoint and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Hilaire Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Upper part—rapid; lower part—slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 3 percent

Taxonomic classification: Sandy over clayey, mixed over smectitic Aquic Haploborolls

Typical Pedon

Hilaire loamy fine sand, 1,800 feet north and 2,500 feet east of the southwest corner of sec. 6, T. 155 N., R. 47 W.

Ap—0 to 11 inches; black (10YR 2/1) loamy fine sand, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; very

friable; few very fine roots; 1 percent gravel; neutral; abrupt smooth boundary.

Bw1—11 to 22 inches; dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) fine sand; weak fine subangular blocky structure; very friable; few very fine roots; 1 percent gravel; neutral; clear wavy boundary.

Bw2—22 to 34 inches; light olive brown (2.5Y 5/4) fine sand; common fine and medium distinct dark brown (10YR 4/3) iron concentrations; single grain; loose; 1 percent gravel; slightly alkaline; clear smooth boundary.

2Bk—34 to 60 inches; olive gray (5Y 4/2) clay; many fine and medium faint very dark gray (5Y 3/1) iron depletions and common fine prominent olive brown (2.5Y 4/4) iron concentrations; moderate medium angular blocky structure; firm; common fine soft masses of carbonates; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 6 to 34 inches

Thickness of the mollic epipedon: 10 to 12 inches

Thickness of the sandy mantle: 20 to 40 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—loamy fine sand

Content of rock fragments—0 to 2 percent

Bw horizon:

Hue—10YR or 2.5Y

Value—3 to 5

Chroma—2 to 4

Texture—fine sand or loamy fine sand

Content of rock fragments—0 to 2 percent

2Bk horizon:

Hue—5Y or 2.5Y

Value—4 or 5

Chroma—1 or 2

Texture—clay or silty clay

Content of rock fragments—0 to 5 percent

647—Hilaire loamy fine sand

Composition

Hilaire and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 5.0 feet
Available water capacity to 60 inches or root-limiting layer: About 7.3 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Wyandotte and similar soils
- Clearwater and similar soils
- Flaming and similar soils
- Thiefriver and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Huot Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderately rapid; lower part—slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Sandy over clayey, mixed over smectitic, frigid Aquic Calciborolls

Typical Pedon

Huot fine sandy loam, 1,700 feet north and 800 feet east of the southwest corner of sec. 1, T. 154 N., R. 44 W.

Ap—0 to 9 inches; black (N 2/0) fine sandy loam,

black (10YR 2/1) dry; weak fine subangular blocky structure; very friable; few fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—9 to 16 inches; dark gray (10YR 4/1) loamy fine sand; weak fine subangular blocky structure; very friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—16 to 21 inches; grayish brown (2.5Y 5/2) fine sand; few fine distinct light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; disseminated carbonates; strongly effervescent; slightly alkaline; clear wavy boundary.

C1—21 to 29 inches; yellowish brown (10YR 5/4) fine sand; few fine faint yellowish brown (10YR 5/6) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline; clear wavy boundary.

2C2—29 to 60 inches; dark gray (5Y 4/1) silty clay; few medium prominent dark yellowish brown (10YR 4/6) iron concentrations; moderate medium subangular blocky structure; firm; few fine masses of carbonates; 2 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 14 inches

Thickness of the sandy mantle: 20 to 40 inches

A horizon:

Hue—10YR or neutral

Value—2

Chroma—0 or 1

Texture—fine sandy loam

Bk horizon:

Hue—10YR or 2.5Y

Value—4 or 5

Chroma—1 to 3

Texture—loamy fine sand or fine sand

C horizon:

Hue—2.5Y or 10YR

Value—4 to 6

Chroma—3 or 4

Texture—fine sand or loamy fine sand

2C horizon:

Hue—2.5Y or 5Y

Value—4 or 5

Chroma—1 or 2

Texture—silty clay, clay, or clay loam

Content of rock fragments—1 to 5 percent

643—Huot fine sandy loam**Composition**

Huot and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 7.3 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Wyandotte and similar soils
- Espelie and similar soils
- Hilaire and similar soils
- Soils that have less clay in the substratum
- Clearwater and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Karlstad Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Upper part—moderately rapid; lower part—rapid

Landform: Beach ridges on lake plains

Parent material: Beach deposits

Slope range: 0 to 3 percent

Taxonomic classification: Coarse-loamy, mixed, superactive Aquic Eutroboralfs

Typical Pedon

Karlstad loamy sand, 1,200 feet south and 350 feet west of the northeast corner of sec. 36, T. 158 N., R. 44 W.

A—0 to 3 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; few fine roots; 2 percent gravel; neutral; clear smooth boundary.

E1—3 to 6 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; few fine roots; 2 percent gravel; neutral; clear smooth boundary.

E2—6 to 12 inches; brown (10YR 5/3) sand; common fine distinct brownish yellow (10YR 6/6) iron concentrations and few fine faint grayish brown (10YR 5/2) iron depletions; single grain; loose; few fine roots; 2 percent gravel; slightly acid; clear wavy boundary.

Bt1—12 to 16 inches; brown (10YR 4/3) sandy loam; few fine distinct dark yellowish brown (10YR 4/6) iron concentrations; moderate medium subangular blocky structure; friable; few fine roots; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; 5 percent gravel; neutral; clear wavy boundary.

2Bt2—16 to 19 inches; brown (10YR 4/3) gravelly sandy loam; few fine distinct dark yellowish brown (10YR 3/6) iron concentrations and few fine faint dark grayish brown (10YR 4/2) iron depletions; moderate medium subangular blocky structure; friable; few roots matted around stones; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; 20 percent gravel; neutral; clear smooth boundary.

2C—19 to 60 inches; pale brown (10YR 6/3) very gravelly coarse sand; common fine faint brown (10YR 5/3) and few fine distinct brownish yellow (10YR 6/6) iron concentrations; single grain; loose; 50 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 12 to 24 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loamy sand

Content of rock fragments—0 to 15 percent

E horizon:

Hue—10YR

Value—4 to 6
 Chroma—2 or 3
 Texture—sand or loamy sand
 Content of rock fragments—0 to 5 percent

Bt horizon:

Hue—10YR or 7.5YR
 Value—3 to 5
 Chroma—2 to 4
 Texture—sandy loam or sandy clay loam
 Content of rock fragments—0 to 10 percent

2Bt horizon:

Hue—10YR
 Value—4
 Chroma—3
 Texture—gravelly sandy loam
 Content of rock fragments—15 to 25 percent

2C horizon:

Hue—10YR or 2.5Y
 Value—5 to 7
 Chroma—2 to 4
 Texture—very gravelly coarse sand, very gravelly loamy sand, gravelly coarse sand, gravelly sand, coarse sand, sand, or fine sand
 Content of rock fragments—5 to 50 percent

205—Karlstad loamy sand**Composition**

Karlstad and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Slight rises on beach plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Beach deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 3.6 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Strandquist and similar soils
- Syrene and similar soils
- Radium and similar soils
- Marquette and similar soils
- Kratka and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Kittson Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderately slow or moderate

Landform: Lake plains

Parent material: Loamy glaciolacustrine deposits and till

Slope range: 0 to 3 percent

Taxonomic classification: Fine-loamy, mixed Aquic Haploborolls

Typical Pedon

Kittson loam, 200 feet south and 1,850 feet east of the northwest corner of sec. 25, T. 155 N., R. 45 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; few fine roots; 1 percent gravel; slightly alkaline; abrupt smooth boundary.

AB—8 to 11 inches; very dark gray (10YR 3/1) and dark brown (10YR 4/3) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; very friable; few fine roots; 1 percent gravel; neutral; clear wavy boundary.

Bw—11 to 15 inches; dark brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; very friable; 1 percent gravel; neutral; clear wavy boundary.

2Bk1—15 to 23 inches; light yellowish brown (2.5Y 6/4) loam; few fine prominent yellowish brown (10YR 5/6) iron concentrations and few fine distinct grayish brown (10YR 5/2) iron depletions; weak fine subangular blocky structure; friable; common fine masses of carbonates; 3 percent gravel; strongly effervescent; slightly alkaline; gradual wavy boundary.

2Bk2—23 to 33 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent yellowish brown (10YR 5/6) and many medium and coarse distinct light yellowish brown (2.5Y 6/4) iron concentrations; weak fine subangular blocky structure; friable; common fine masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline; clear smooth boundary.

2C—33 to 60 inches; light brownish gray (2.5Y 6/2) loam; many coarse distinct light yellowish brown (2.5Y 6/4) iron concentrations; massive with fine blocky soil fragments; friable; common fine masses of carbonates; 5 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 11 to 15 inches

Thickness of the mollic epipedon: 7 to 10 inches

A horizon:

Hue—10YR

Value—2

Chroma—1

Texture—loam

Content of rock fragments—0 to 1 percent

AB horizon:

Hue—10YR

Value—3 or 4

Chroma—1 to 3

Texture—sandy loam, fine sandy loam, or loam

Content of rock fragments—0 to 1 percent

Bw horizon:

Hue—10YR

Value—3 or 4

Chroma—2 or 3

Texture—fine sandy loam, loam, or sandy loam

Content of rock fragments—0 to 1 percent

2Bk and 2C horizons:

Hue—10YR or 2.5Y

Value—5 or 6

Chroma—2 to 4

Texture—loam

Content of rock fragments—2 to 5 percent

58—Kittson loam

Composition

Kittson and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 10.5 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Foldahl and similar soils
- Hamerly and similar soils
- Roliss and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Kratka Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Upper part—moderately rapid or rapid; lower part—moderate or moderately slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 2 percent

Taxonomic classification: Sandy over loamy, mixed, superactive, frigid Typic Endoaquolls

Typical Pedon

Kratka fine sandy loam, 200 feet south and 100 feet east of the northwest corner of sec. 11, T. 154 N., R. 39 W.

Ap—0 to 9 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to moderate fine granular; very friable; few very fine roots; neutral; abrupt smooth boundary.

A—9 to 13 inches; very dark grayish brown (10YR 3/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; few fine prominent dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/8) iron concentrations; weak medium subangular blocky structure; very friable; few very fine roots; 1 percent gravel; neutral; clear smooth boundary.

Bg—13 to 26 inches; dark grayish brown (2.5Y 4/2) fine sand; common medium prominent yellowish brown (10YR 5/6) iron concentrations; single grain; loose; 1 percent gravel; neutral; clear wavy boundary.

2Bkg—26 to 60 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent yellowish brown (10YR 5/6) iron concentrations; moderate medium subangular blocky structure; friable; common fine and medium soft masses of carbonates; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 20 to 40 inches

Thickness of the mollic epipedon: 8 to 15 inches

Thickness of the sandy mantle: 20 to 40 inches

Ap and A horizons:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 to 2

Texture—fine sandy loam or loamy fine sand

Bg horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—1 to 4

Texture—fine sand, sand, loamy fine sand, or loamy sand

Content of rock fragments—0 to 5 percent

2Bkg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—2 or 3

Texture—loam or clay loam

Content of rock fragments—1 to 5 percent

481—Kratka fine sandy loam

Composition

Kratka and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 7.9 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Foldahl and similar soils
- Smiley and similar soils
- Northwood and similar soils
- Deerwood and similar soils
- Strandquist and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Lamoure Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Moderate or moderately slow

Landform: Flood plains

Parent material: Alluvium

Slope range: 0 to 2 percent

Taxonomic classification: Fine-silty, mixed, superactive, calcareous, frigid Cumulic Endoaquolls

Typical Pedon

Lamoure silty clay loam, occasionally flooded, 2,750

feet south and 1,950 feet east of the northwest corner of sec. 6, T. 156 N., R. 48 W.

Ap—0 to 10 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak very fine subangular blocky structure; friable; few very fine roots; slightly effervescent; slightly alkaline; abrupt smooth boundary.

A—10 to 15 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; few very fine roots; few snail shells; common fine threads of carbonate; strongly effervescent; slightly alkaline; clear smooth boundary.

Cg1—15 to 21 inches; very dark grayish brown (2.5Y 3/2) silty clay loam, gray (10YR 5/1) dry; few fine prominent strong brown (7.5YR 4/6) iron concentrations; massive with weak very fine subangular blocky fragments; friable; few very fine roots; few snail shells; common fine threads of carbonate; strongly effervescent; slightly alkaline; clear smooth boundary.

Cg2—21 to 42 inches; very dark grayish brown (2.5Y 3/2) silt loam, gray (10YR 5/1) dry; common fine prominent dark brown (7.5YR 3/4) iron concentrations and light brownish gray (2.5Y 6/2) iron depletions; massive with weak very fine blocky fragments; friable; few very fine roots; few snail shells; common fine threads of carbonate; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Ab—42 to 49 inches; black (5Y 2.5/1) silty clay, dark gray (10YR 4/1) dry; few fine prominent strong brown (7.5YR 4/6) iron concentrations; moderate very fine subangular blocky structure; firm; few snail shells; slightly effervescent; slightly alkaline; gradual wavy boundary.

2Cg—49 to 60 inches; olive gray (5Y 5/2) silty clay loam; few fine prominent strong brown (7.5YR 4/6) iron concentrations; massive with moderate very fine blocky fragments; firm; few fine soft masses of carbonate; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches

Thickness of the mollic epipedon: 24 to 45 inches

Ap and A horizons:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay loam

Cg and 2Cg horizons:

Hue—2.5Y or 5Y

Value—3 to 5

Chroma—1 or 2

Texture—silt loam or silty clay loam

Ab horizon:

Hue—5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay loam or silty clay

418—Lamoure silty clay loam, occasionally flooded

Composition

Lamoure and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and swales on flood plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Alluvium

Flooding: Occasional

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

Available water capacity to 60 inches or root-limiting layer: About 10.6 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Fargo and similar soils
- Bearden and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Linveldt Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Upper part—rapid or moderately rapid;
lower part—moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 3 percent

Taxonomic classification: Coarse-loamy, superactive,
mixed Aquic Argiborolls

Typical Pedon

Linveldt fine sandy loam, 2,300 feet south and 1,750 feet west of the northeast corner of sec. 28, T. 157 N., R. 45 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; weak fine subangular blocky structure; very friable; few very fine roots; 2 percent gravel; neutral; abrupt smooth boundary.

E—10 to 13 inches; grayish brown (10YR 5/2) loamy sand; few fine distinct dark yellowish brown (10YR 4/4) iron concentrations; weak fine granular structure parting to single grain; very friable; few very fine roots; 2 percent gravel; neutral; clear smooth boundary.

Bt—13 to 19 inches; brown (10YR 4/3) sandy loam; few fine faint dark yellowish brown (10YR 4/4) iron concentrations; weak medium subangular blocky structure; friable; few very fine roots; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds and in pores; 2 percent gravel; neutral; clear smooth boundary.

2Bw1—19 to 23 inches; brown (10YR 5/3) sand; common fine distinct yellowish brown (10YR 5/6) iron concentrations and few fine faint dark grayish brown (10YR 4/2) iron depletions; single grain; loose; 2 percent gravel; slightly alkaline; clear smooth boundary.

2Bw2—23 to 31 inches; light yellowish brown (10YR 6/4) sand; few fine distinct brownish yellow (10YR 6/6) iron concentrations; single grain; loose; 8 percent gravel; slightly effervescent; slightly alkaline; abrupt wavy boundary.

3C—31 to 60 inches; light brownish gray (2.5Y 6/2) loam; few fine prominent dark yellowish brown (10YR 4/6) and common fine prominent brownish yellow (10YR 6/8) iron concentrations; massive with medium blocky soil fragments; friable; few medium masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 15 to 25 inches

Thickness of the mollic epipedon: 7 to 12 inches

Thickness of the sandy mantle: 20 to 40 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—fine sandy loam

Content of rock fragments—2 to 5 percent

E horizon:

Hue—10YR

Value—4 or 5

Chroma—1 or 2

Texture—loamy sand, loamy fine sand, or sandy loam

Content of rock fragments—2 to 5 percent

Bt horizon:

Hue—10YR

Value—4

Chroma—3

Texture—sandy loam, fine sandy loam, or loam

Content of rock fragments—2 to 5 percent

2Bw horizon:

Hue—10YR or 2.5Y

Value—5 or 6

Chroma—3 or 4

Texture—sand or loamy fine sand

Content of rock fragments—0 to 35 percent

3C horizon:

Hue—2.5Y

Value—6

Chroma—2

Texture—loam or clay loam

Content of rock fragments—2 to 5 percent

713—Linveldt fine sandy loam**Composition**

Linveldt and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 8.7 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Smiley and similar soils
- Kratka and similar soils
- Reiner and similar soils
- Eckvoll and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Lupton Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Moderately slow to moderately rapid

Landform: Lake plains

Parent material: Organic materials

Slope range: 0 to 1 percent

Taxonomic classification: Euic Typic Borosaprists

Typical Pedon

Lupton muck, 800 feet north and 1,300 feet east of the southwest corner of sec. 32, T. 157 N., R. 41 W.

Oa1—0 to 12 inches; dark reddish brown (5YR 2/2) muck; 70 percent fiber, 15 percent rubbed; weak coarse granular structure; very friable; 10 percent woody fragments, stems, and sticks; very strongly acid; gradual smooth boundary.

Oe—12 to 21 inches; dark reddish brown (5YR 3/2) mucky peat; 85 percent fiber, 25 percent rubbed; weak coarse subangular blocky structure parting to weak medium granular; very friable; 5 percent

woody fragments, stems, and sticks; very strongly acid; gradual smooth boundary.

Oa2—21 to 60 inches; black (5YR 2.5/1) muck; 10 percent fiber, trace rubbed; weak fine and medium subangular blocky structure; very friable; few woody fragments; strongly acid.

Range in Characteristics

Thickness of the histic epipedon: More than 60 inches

Other features: Some pedons have an Oi horizon of living sphagnum material 2 to 4 inches thick.

Oa horizons:

Hue—5YR or neutral

Value—2 or 3

Chroma—0 to 2

Texture—muck

Oe horizon:

Hue—5YR or neutral

Value—2 or 3

Chroma—0 to 2

Texture—mucky peat

546—Lupton muck

Composition

Lupton and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains

Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Organic materials

Flooding: None

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

Available water capacity to 60 inches or root-limiting layer: About 24.0 inches

Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a mineral surface layer
- Seelyeville and similar soils
- Soils that are ponded
- Cathro and similar soils
- Markey and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Markey Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Upper part—moderately slow to moderately rapid; lower part—rapid

Landform: Lake plains

Parent material: Organic materials and glaciolacustrine deposits

Slope range: 0 to 1 percent

Taxonomic classification: Sandy or sandy-skeletal, mixed, euic Terric Borosaprists

Typical Pedon

Markey muck, 700 feet south and 850 feet east of the northwest corner of sec. 5, T. 154 N., R. 44 W.

Oa—0 to 25 inches; black (10YR 2/1) muck; 25 percent fiber, 10 percent rubbed; weak thin platy structure; very friable; few fine roots; moderately acid; clear smooth boundary.

A—25 to 28 inches; black (2.5Y 2/0) mucky fine sandy loam; weak coarse subangular blocky structure; friable; few fine masses of carbonates; slightly effervescent; neutral; abrupt smooth boundary.

Cg1—28 to 34 inches; light brownish gray (2.5Y 6/2) loamy sand; common fine prominent olive yellow (2.5Y 6/6) iron concentrations; weak medium and coarse subangular blocky structure; very friable; 4 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

Cg2—34 to 60 inches; light brownish gray (2.5Y 6/2) sand; common medium distinct light yellowish brown (2.5Y 6/4) and many fine prominent strong brown (7.5YR 5/6) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 25 to 44 inches

Thickness of the histic epipedon: 16 to 42 inches

Oa horizon:

Hue—10YR or 5YR

Value—2 or 3

Chroma—1 or 2

Texture—muck

A horizon:

Hue—2.5Y, 10YR, or neutral

Value—2

Chroma—0 or 1

Texture—mucky fine sandy loam, mucky sand, fine sandy loam, loamy sand, or sandy loam

Content of rock fragments—0 to 15 percent

Cg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—1 or 2

Texture—coarse sand, sand, fine sand, loamy sand, or gravelly sand

Content of rock fragments—0 to 25 percent

543—Markey muck

Composition

Markey and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains

Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Organic materials and glaciolacustrine deposits

Flooding: None

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

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 11.9 inches

Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is



Figure 9.—Typical profile of Fargo silty clay. The dark surface layer extends to a depth of about 12 inches. Depth is marked in inches.

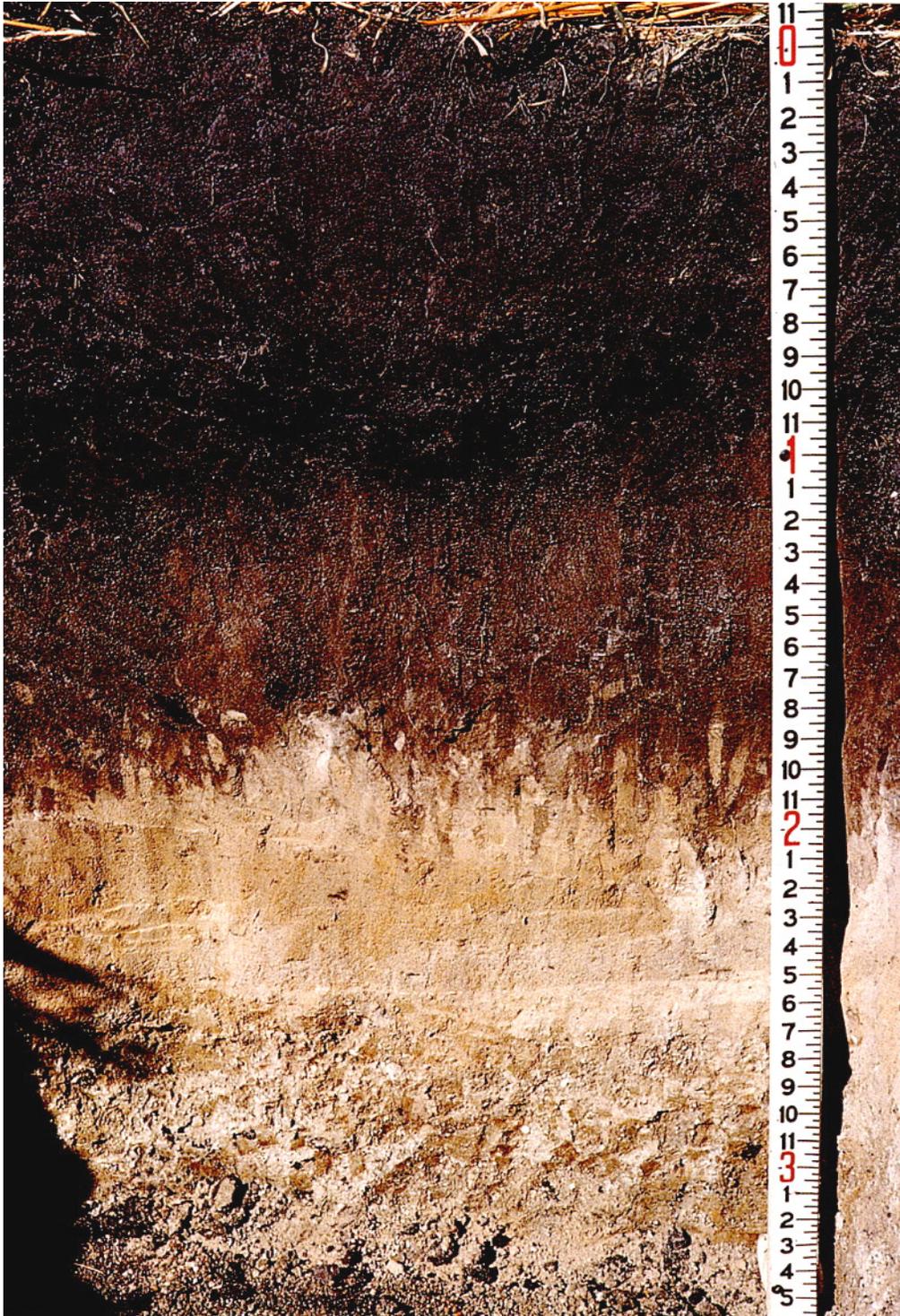


Figure 10.—Typical profile of Strathcona fine sandy loam. A layer of carbonate accumulation extends from a depth of 12 to 31 inches. Depth is marked in inches.

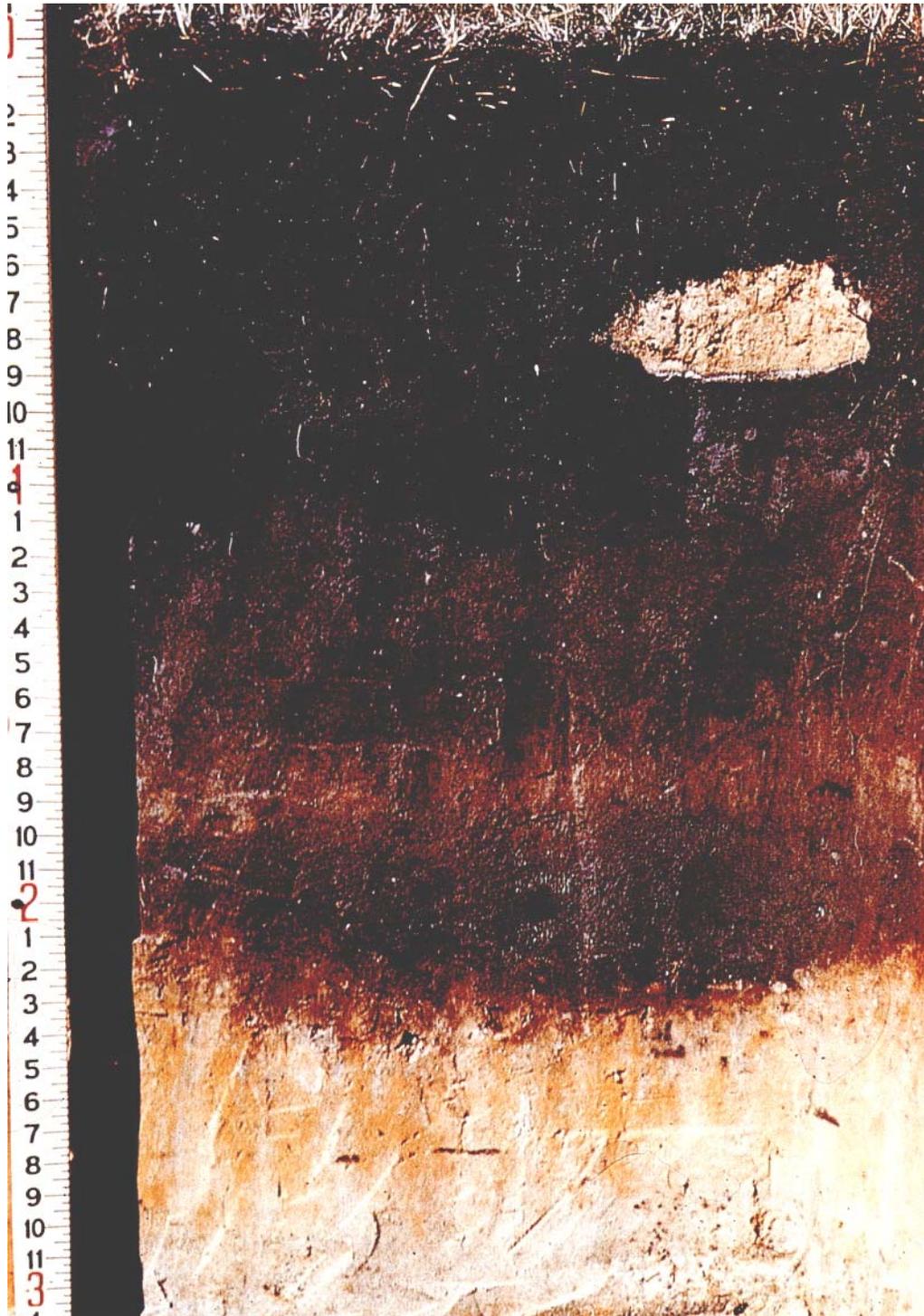


Figure 11.—Typical profile of Ulen loamy fine sand. A layer of carbonate accumulation extends from a depth of 7 to 26 inches. Depth is marked in inches.

available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a mineral surface layer
- Deerwood and similar soils
- Soils that are ponded
- Seelyeville and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1808—Markey muck, ponded

Composition

Markey and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains

Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Organic materials and glaciolacustrine deposits

Flooding: None

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

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 17.1 inches

Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Deerwood and similar soils
- Berner and similar soils
- Seelyeville and similar soils
- Hamre and similar soils
- Soils that have a mineral surface layer

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Marquette Series

Depth class: Very deep

Drainage class: Excessively drained

Permeability: Upper part—moderately rapid; lower part—very rapid

Landform: Beach ridges on lake plains

Parent material: Beach deposits

Slope range: 1 to 8 percent

Taxonomic classification: Loamy-skeletal, mixed, superactive Ochreptic Eutroboralfs

Typical Pedon

Marquette loamy sand, 1 to 8 percent slopes, 2,600 feet south and 200 feet east of the northwest corner of sec. 31, T. 158 N., R. 42 W.

Ap—0 to 7 inches; black (10YR 2/1) loamy sand, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; very friable; few fine and medium roots; 5 percent gravel; neutral; abrupt smooth boundary.

Bt1—7 to 10 inches; brown (10YR 4/3) sandy loam; moderate fine subangular blocky structure; friable; few fine roots; common distinct dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) clay bridging on sand grains; 10 percent gravel; neutral; clear smooth boundary.

Bt2—10 to 13 inches; dark yellowish brown (10YR 3/4) extremely gravelly sandy loam; moderate fine subangular blocky structure; friable; common fine roots; common distinct dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) clay bridging on sand grains; 65 percent gravel; neutral; clear smooth boundary.

C1—13 to 29 inches; brown (10YR 5/3) extremely gravelly coarse sand; single grain; loose; few fine roots; 65 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.

C2—29 to 60 inches; grayish brown (10YR 5/2) gravelly coarse sand; single grain; loose; 25 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 10 to 24 inches

A horizon:

Hue—10YR
 Value—2 or 3
 Chroma—1 or 2
 Texture—loamy sand
 Content of rock fragments—1 to 5 percent

Bt horizon:

Hue—7.5YR or 10YR
 Value—3 to 5
 Chroma—3 or 4
 Texture—extremely gravelly sandy loam, very gravelly sandy loam, very gravelly loam, very gravelly coarse sandy loam, or sandy loam
 Content of rock fragments—averages 35 to 65 percent

C horizon:

Hue—10YR
 Value—5 or 6
 Chroma—2 or 3
 Texture—extremely gravelly coarse sand, very gravelly coarse sand, gravelly coarse sand, very gravelly sand, coarse sand, or sand
 Content of rock fragments—10 to 65 percent

242B—Marquette loamy sand, 1 to 8 percent slopes**Composition**

Marquette and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Beach ridges
Position on the landform: Summits and backslopes
Slope: 1 to 8 percent

Component Description

Surface layer texture: Loamy sand
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Beach deposits
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Syrene and similar soils
- Kratka and similar soils
- Sahkahtay and similar soils
- Karlstad and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Mavie Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Upper part—rapid; lower part—moderate or moderately slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 2 percent

Taxonomic classification: Sandy-skeletal over loamy, mixed, superactive, frigid Typic Calciaquolls

Typical Pedon

Mavie fine sandy loam, 900 feet north and 200 feet east of the southwest corner of sec. 36, T. 155 N., R. 46 W.

Ap—0 to 10 inches; black (N 2/0) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few fine roots; 1 percent gravel; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg—10 to 16 inches; grayish brown (2.5Y 5/2) fine sandy loam; common fine and medium distinct gray (5Y 5/1) iron depletions; weak fine subangular blocky structure; very friable; few fine roots; disseminated carbonates; 1 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

2Cg1—16 to 27 inches; light brownish gray (2.5Y 6/2) very gravelly sand; common fine distinct olive brown (2.5Y 4/4) and light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; disseminated carbonates; 55 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

3Cg2—27 to 60 inches; grayish brown (2.5Y 5/2) loam; many fine faint light brownish gray (2.5Y 6/2) iron depletions and common medium

prominent yellowish brown (10YR 5/6) iron concentrations; massive with medium blocky soil fragments; friable; few fine masses of carbonates; 7 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 12 inches

Thickness of the upper mantle: 20 to 40 inches

A horizon:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 to 2

Texture—fine sandy loam

Content of rock fragments—1 to 15 percent

Bkg horizon:

Hue—2.5Y

Value—4 to 6

Chroma—1 or 2

Texture—fine sandy loam, loam, or sandy loam

Content of rock fragments—1 to 15 percent

2Cg horizon:

Hue—2.5Y

Value—5 or 6

Chroma—2

Texture—very gravelly coarse sand, very gravelly sand, or extremely gravelly sand

Content of rock fragments—35 to 65 percent

3Cg horizon:

Hue—2.5Y

Value—5 or 6

Chroma—2

Texture—loam

Content of rock fragments—1 to 8 percent

412—Mavie fine sandy loam

Composition

Mavie and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 8.7 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Foxhome and similar soils
- Roliss and similar soils
- Grimstad and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Nereson Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderate or moderately rapid

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 3 percent

Taxonomic classification: Coarse-loamy, mixed, superactive Aquic Argiborolls

Typical Pedon

Nereson fine sandy loam, 2,300 feet south and 50 feet west of the northeast corner of sec. 27, T. 158 N., R. 45 W.

A—0 to 7 inches; black (10YR 2/1) fine sandy loam, dark gray (10YR 4/1) dry; moderate very fine subangular blocky structure; friable; many fine roots; neutral; abrupt smooth boundary.

E—7 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam; moderate fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bt—10 to 18 inches; brown (10YR 5/3) loam; moderate medium angular blocky structure; firm;

few very fine roots; few thin dark brown (10YR 3/3) clay films on faces of peds and in pores and some clay bridging between sand grains; 2 percent gravel; neutral; clear smooth boundary.

2Bw—18 to 20 inches; light brownish gray (2.5Y 6/2) gravelly loam; few fine distinct light olive brown (2.5Y 5/4) iron concentrations; moderate medium subangular blocky structure parting to weak fine subangular blocky; friable; few very fine roots; 20 percent gravel; slightly effervescent; moderately alkaline; clear wavy boundary.

2Bkg—20 to 33 inches; light brownish gray (2.5Y 7/2) loam; common fine distinct light yellowish brown (2.5Y 6/4) iron concentrations; moderate medium subangular blocky structure parting to weak fine subangular blocky; friable; few very fine roots; 10 percent gravel; disseminated lime; violently effervescent; moderately alkaline; clear wavy boundary.

2Cg—33 to 60 inches; light brownish gray (2.5Y 6/2) loam; many fine distinct light olive brown (2.5Y 5/6) iron concentrations and few medium distinct gray (10YR 5/1) iron depletions; massive breaking to medium blocky soil fragments; friable; 12 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 10 to 22 inches

Thickness of the mollic epipedon: 7 to 14 inches

A horizon:

Hue—10YR

Value—2

Chroma—1

Texture—fine sandy loam

Content of rock fragments—0 to 8 percent

E horizon:

Hue—10YR

Value—4 or 5

Chroma—2

Texture—fine sandy loam

Content of rock fragments—0 to 8 percent

Bt horizon:

Hue—10YR or 2.5Y

Value—3 to 5

Chroma—2 or 3

Texture—fine sandy loam, sandy clay loam, loam, or sandy loam

Content of rock fragments—0 to 5 percent

2Bw horizon:

Hue—2.5Y or 10YR

Value—4 to 6

Chroma—2

Texture—gravelly loam, gravelly fine sandy loam, or gravelly sandy loam

Content of rock fragments—15 to 30 percent

2Bkg horizon:

Hue—2.5Y or 10YR

Value—5 to 7

Chroma—2 or 3

Texture—loam, sandy loam, fine sandy loam, gravelly loam, or gravelly sandy loam

Content of rock fragments—10 to 20 percent

2Cg horizon:

Hue—2.5Y

Value—6

Chroma—2

Texture—loam, fine sandy loam, gravelly loam, or gravelly sandy loam

Content of rock fragments—10 to 20 percent

583—Nereson fine sandy loam

Composition

Nereson and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 10.2 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Percy and similar soils
- Enstrom and similar soils
- Foxhome and similar soils

- Skagen and similar soils
- Soils that have a very cobbly surface layer

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Newfolden Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Upper part—slow; lower part—moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 3 percent

Taxonomic classification: Fine, mixed over smectitic, superactive Abruptic Udic Argiborolls

Typical Pedon

Newfolden loam, 300 feet south and 2,500 feet west of the northeast corner of sec. 35, T. 155 N., R. 43 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

Bt—7 to 16 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; few fine distinct grayish brown (10YR 5/2) iron depletions; moderate coarse angular blocky structure; firm; common distinct very dark brown (10YR 2/2) clay films on faces of peds and in pores; neutral; clear wavy boundary.

2Bk1—16 to 25 inches; grayish brown (2.5Y 5/2) clay loam; common fine distinct yellowish brown (10YR 5/4) iron concentrations; weak medium subangular blocky structure; friable; many soft masses of carbonates; 3 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk2—25 to 36 inches; light brownish gray (2.5Y 6/2) clay loam; many medium prominent brownish yellow (10YR 6/6) iron concentrations; weak medium subangular blocky structure; friable; many soft masses of carbonates; 3 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

2C—36 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam; many coarse prominent brownish yellow (10YR 6/6) iron concentrations; massive with medium blocky soil fragments; friable; common soft masses of carbonates; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 10 to 29 inches

Thickness of the mollic epipedon: 7 to 18 inches

Other features: Some pedons have a BC horizon.

A horizon:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 to 2

Texture—loam

Content of rock fragments—0 to 3 percent

Bt horizon:

Hue—10YR or 2.5Y

Value—2 to 5

Chroma—1 to 3

Texture—clay or clay loam

Content of rock fragments—0 to 5 percent

2Bk or 2Bkg horizon:

Hue—2.5Y

Value—5 or 6

Chroma—2 to 4

Texture—clay loam or loam

Content of rock fragments—2 to 10 percent

2C horizon:

Hue—2.5Y

Value—5 or 6

Chroma—2 to 4

Texture—clay loam or loam

Content of rock fragments—2 to 10 percent

648—Newfolden loam

Composition

Newfolden and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 10.5 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Boash and similar soils
- Clearwater and similar soils
- Kratka and similar soils
- Roliss and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Northcote Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 2 percent

Taxonomic classification: Very fine, smectitic, frigid
Typic Epiaquerts

Typical Pedon

Northcote clay, 0 to 2 percent slopes, 2,300 feet south and 100 feet west of the northeast corner of sec. 1, T. 158 N., R. 49 W.

Ap—0 to 10 inches; black (N 2/0) clay, very dark gray (N 3/0) dry; moderate fine subangular blocky structure; firm; few very fine and fine roots; neutral; abrupt smooth boundary.

Bssg1—10 to 16 inches; dark gray (5Y 4/1) clay; weak coarse prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; few distinct intersecting slickensides

on faces of peds with a slant of less than 45 degrees above the horizontal; cracks 1/4 inch to 3 inches wide and 2 to 4 feet apart filled with material from the A horizon; neutral; clear smooth boundary.

Bssg2—16 to 29 inches; dark gray (5Y 4/1) clay; weak coarse prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks 1/4 inch to 2 inches wide and 2 to 4 feet apart filled with material from the A horizon; slightly effervescent; slightly alkaline; gradual smooth boundary.

Bssg3—29 to 49 inches; olive gray (5Y 4/2) clay; common fine faint olive (5Y 4/3) iron concentrations; moderate fine subangular blocky structure; firm; few very fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks 1/4 to 1 inch wide and 3 to 4 feet apart filled with material from the A horizon; few fine soft masses of carbonates; slightly effervescent; moderately alkaline; gradual smooth boundary.

Cg—49 to 60 inches; olive gray (5Y 4/2) clay; many fine prominent light olive brown (2.5Y 5/6) and common fine faint olive (5Y 4/3) iron concentrations; massive with fine blocky soil fragments; firm; common fine soft masses of carbonates; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 14 to 30 inches

Thickness of the mollic epipedon: 10 to 18 inches

Content of clay: 60 to 80 percent in the 10- to 40-inch control section

A horizon:

Hue—10YR, 2.5Y, or neutral

Value—2

Chroma—0 or 1

Texture—clay

Bssg horizon:

Hue—5Y

Value—3 or 4

Chroma—1 or 2

Texture—clay

Cg horizon:

Hue—5Y

Value—4 or 5

Chroma—1 or 2

Texture—clay

429A—Northcote clay, 0 to 2 percent slopes

Composition

Northcote and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1 to 3 feet
Available water capacity to 60 inches or root-limiting layer: About 7.5 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Eaglepoint and similar soils
- Colvin and similar soils
- Fargo and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Northwood Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderately rapid; next part—rapid; lower part—moderate
Landform: Lake plains
Parent material: Organic materials and glaciolacustrine deposits or till
Slope range: 0 to 1 percent
Taxonomic classification: Sandy over loamy, mixed, nonacid, frigid Histic Humaquepts

Typical Pedon

Northwood muck, 1,500 feet north and 1,000 feet east of the southwest corner of sec. 9, T. 157 N., R. 42 W.

Oa—0 to 12 inches; black (10YR 2/1) muck; 20 percent fiber, 10 percent rubbed; weak thin platy structure; very friable; common fine roots; slightly acid; abrupt smooth boundary.

A—12 to 20 inches; black (N 2/0) fine sandy loam; weak fine subangular blocky structure; very friable; few fine roots; neutral; clear wavy boundary.

Bg1—20 to 26 inches; dark grayish brown (2.5Y 4/2) loamy fine sand; few fine prominent brownish yellow (10YR 6/6) iron concentrations; single grain; loose; 1 percent gravel; neutral; clear wavy boundary.

Bg2—26 to 34 inches; light brownish gray (2.5Y 6/2) coarse sand; common medium prominent olive yellow (2.5Y 6/6) iron concentrations; single grain; loose; 12 percent gravel; slightly effervescent; neutral; clear wavy boundary.

2Cg—34 to 60 inches; light brownish gray (2.5Y 6/2) loam; common medium prominent light olive brown (2.5Y 5/6) and few medium prominent dark yellowish brown (10YR 4/6) iron concentrations; massive with medium blocky soil fragments; friable; common fine soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 30 inches

Thickness of the histic epipedon: 8 to 16 inches

Depth to glacial till: 20 to 40 inches

Oa horizon:

Hue—10YR

Value—2

Chroma—1 or 2

Texture—muck

A horizon:

Hue—10YR, 2.5Y, or neutral

Value—2 or 3

Chroma—0 or 1

Texture—fine sandy loam, mucky fine sandy loam, or sandy loam

Content of rock fragments—0 to 5 percent

Bg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—2

Texture—coarse sand, sand, loamy sand, loamy fine sand, or fine sand
Content of rock fragments—0 to 15 percent

2Cg horizon:

Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—loam, silty clay loam, or clay loam
Content of rock fragments—2 to 8 percent

563—Northwood muck**Composition**

Northwood and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits or till
Flooding: None
Depth to the water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 11.3 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Hamre and similar soils
- Kratka and similar soils
- Markey and similar soils
- Other soils that are ponded

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1146—Northwood muck, ponded**Composition**

Northwood and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits or till
Flooding: None
Seasonal high water table: At the surface to 2 feet above the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 12.7 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Soils that have a mineral surface layer
- Berner and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Pelan Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—rapid; lower part—moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Loamy-skeletal, mixed, superactive Aquic Argiborolls

Typical Pedon

Pelan sandy loam, 1,500 feet east and 1,450 feet south of the northwest corner of sec. 32, T. 157 N., R. 43 W.

Ap—0 to 6 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few fine roots; 5 percent gravel; slightly acid; abrupt smooth boundary.

Bt1—6 to 9 inches; brown (10YR 4/3) gravelly coarse sandy loam; moderate medium subangular blocky structure; friable; few fine roots; many very dark grayish brown (10YR 3/2) clay films on faces of peds and bridging sand grains; few fine masses of carbonates; 15 percent gravel; neutral; clear wavy boundary.

Bt2—9 to 12 inches; very dark grayish brown (10YR 3/2) very gravelly sandy loam; weak fine subangular blocky structure; very friable; many dark brown (10YR 3/3) continuous clay films on faces of peds and bridging sand grains; few fine masses of carbonates; 50 percent gravel; slightly alkaline; clear wavy boundary.

Bw1—12 to 16 inches; grayish brown (10YR 5/2) very gravelly coarse sand; single grain; loose; 40 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.

Bw2—16 to 24 inches; light brownish gray (2.5Y 6/2) very gravelly coarse sand; few medium distinct light yellowish brown (2.5Y 6/4) iron concentrations; single grain; loose; 40 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.

2Bk—24 to 60 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent light olive brown (2.5Y 5/6) and few medium prominent dark yellowish brown (10YR 4/6) iron concentrations; weak fine and medium subangular blocky structure; friable; common fine soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 11 to 20 inches

Depth to glacial till: 20 to 40 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—sandy loam

Content of rock fragments—2 to 5 percent

Bt horizon:

Hue—10YR

Value—3 or 4

Chroma—2 or 3

Texture—very gravelly sandy loam, gravelly coarse sandy loam, or gravelly sandy loam

Content of rock fragments—averages 35 to 60 percent

Bw horizon:

Hue—10YR or 2.5Y

Value—5 or 6

Chroma—2

Texture—very gravelly coarse sand, gravelly sand, or gravelly fine sand

Content of rock fragments—15 to 60 percent

2Bk horizon:

Hue—2.5Y

Value—5 or 6

Chroma—2

Texture—loam

Content of rock fragments—5 to 10 percent

280—Pelan sandy loam

Composition

Pelan and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 7.6 inches

Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Kratka and similar soils
- Smiley and similar soils
- Mavie and similar soils
- Foldahl and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Percy Series

Depth class: Very deep

Drainage class: Poorly drained or very poorly drained

Permeability: Moderate

Landform: Lake plains

Parent material: Till

Slope range: 0 to 2 percent

Taxonomic classification: Coarse-loamy, mixed, frigid
Typic Calciaquolls

Typical Pedon

Percy loam, 1,200 feet south and 2,100 feet west of the northeast corner of sec. 2, T. 158 N., R. 45 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark brown (10YR 2/2) dry; weak fine granular structure; friable; 3 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.

2Bg—8 to 11 inches; dark grayish brown (2.5Y 4/2) gravelly fine sandy loam; common fine distinct light olive brown (2.5Y 5/6) iron concentrations; weak fine and medium subangular blocky structure; friable; 15 percent gravel; 5 percent cobbles; slightly effervescent; slightly alkaline; clear smooth boundary.

2Bkg1—11 to 17 inches; light brownish gray (2.5Y 6/2) loam; common fine distinct light olive brown (2.5Y 5/6) iron concentrations; weak fine and medium subangular blocky structure; friable; disseminated carbonates; 7 percent gravel; 3 percent cobbles; violently effervescent; moderately alkaline; clear wavy boundary.

2Bkg2—17 to 35 inches; grayish brown (2.5Y 5/2) loam; many fine distinct yellowish brown (10YR 5/6) iron concentrations; weak fine and medium subangular blocky structure; friable; many fine carbonate coatings; 10 percent gravel; 3 percent

cobbles; strongly effervescent; moderately alkaline; clear smooth boundary.

2Cg—35 to 60 inches; light brownish gray (2.5Y 6/2) loam; many fine distinct yellowish brown (10YR 5/6 and 5/8) iron concentrations; massive; friable; common fine carbonate coatings; 10 percent gravel; 3 percent cobbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 14 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loam or mucky loam

Content of gravel—0 to 5 percent

2Bg horizon:

Hue—10YR or 2.5Y

Value—4 or 5

Chroma—1 or 2

Texture—fine sandy loam, loamy fine sand, loamy sand, loam, or the gravelly analogs of these textures

Content of gravel—10 to 30 percent

2Bkg horizon:

Hue—10YR or 2.5Y

Value—5 or 6

Chroma—1 or 2

Texture—loam or fine sandy loam

Content of gravel—10 to 13 percent

2Cg horizon:

Hue—2.5Y

Value—5 or 6

Chroma—2

Texture—loam or fine sandy loam

Content of gravel—10 to 13 percent

379—Percy loam, very cobbly

Composition

Percy and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Skagen and similar soils
- Haug and similar soils
- Strandquist and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

383—Percy loam

Composition

Percy and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this

map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Skagen and similar soils
- Haug and similar soils
- Soils that have a very cobbly surface layer
- Strathcona and similar soils
- Nereson and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

384—Percy mucky loam, depressional

Composition

Percy and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Till
Flooding: None
Seasonal high water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 9.7 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Strandquist and similar soils
- Strathcona and similar soils
- Haug and similar soils
- Berner and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1030—Pits, gravel-Udipsamments complex

Composition

Pits: 70 percent

Udipsamments: 20 percent

Inclusions: About 10 percent

Component Description

Pits

Dominant parent material: Beach deposits

Udipsamments

Surface layer texture: Sand

Depth class: Very deep (more than 60 inches)

Drainage class: Excessively drained

Dominant parent material: Beach deposits

Flooding: None

Depth to the water table: Greater than 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 4.0 inches

Organic matter content: Very low

Inclusions

- Marquette and similar soils
- Sandberg and similar soils
- Syrene and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Poppleton Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Rapid

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 3 percent

Taxonomic classification: Mixed, frigid Aquic Udipsamments

Typical Pedon

Poppleton fine sand, 2,600 feet north and 100 feet east of the southwest corner of sec. 23, T. 156 N., R. 47 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) fine sand, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; very friable; few fine roots; neutral; abrupt smooth boundary.

Bw1—6 to 9 inches; grayish brown (10YR 5/3) fine sand; single grain; loose; few fine roots; neutral; clear wavy boundary.

Bw2—9 to 30 inches; brown (10YR 5/3) fine sand; many fine and medium distinct dark yellowish brown (10YR 4/6) iron concentrations and many medium fine faint grayish brown (10YR 5/2) iron depletions; single grain; loose; slightly acid; clear wavy boundary.

C1—30 to 45 inches; pale brown (10YR 6/3) sand; many medium distinct yellowish brown (10YR 5/6) iron concentrations and few fine faint light brownish gray (10YR 6/2) iron depletions; single grain; loose; slightly effervescent; slightly alkaline; gradual wavy boundary.

C2—45 to 60 inches; light brownish gray (2.5Y 6/2) sand; few fine distinct light yellowish brown (10YR 6/4) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 inches or more

Other features: Some pedons have an E horizon.

A horizon:

Hue—10YR

Value—3

Chroma—1 or 2

Texture—fine sand

Content of rock fragments—0 to 1 percent

Bw horizon:

Hue—10YR

Value—5 or 6

Chroma—3 or 4

Texture—fine sand, sand, or loamy sand

C horizon:

Hue—10YR or 2.5Y

Value—5 to 7

Chroma—2 or 3

Texture—sand or fine sand

148—Poppleton fine sand**Composition**

Poppleton and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 4.9 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hamar and similar soils
- Rosewood and similar soils
- Hangaard and similar soils
- Rushlake and similar soils
- Kratka and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Radium Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid
Landform: Beach ridges on lake plains
Parent material: Beach deposits
Slope range: 0 to 3 percent
Taxonomic classification: Sandy, mixed Aquic Haploborolls

Typical Pedon

Radium loamy sand, 1,450 feet south and 500 feet east of the northwest corner of sec. 4, T. 155 N., R. 45 W.

Ap—0 to 14 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few fine roots; 5 percent gravel; neutral; abrupt smooth boundary.

Bw1—14 to 19 inches; very dark grayish brown (10YR 3/2) sand, grayish brown (10YR 5/2) dry; single grain; loose; few fine roots; 10 percent gravel; neutral; gradual smooth boundary.

Bw2—19 to 33 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; 12 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.

C1—33 to 43 inches; dark grayish brown (10YR 4/2) very gravelly coarse sand; few fine faint grayish brown (10YR 5/2) iron depletions; single grain; loose; 50 percent gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C2—43 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 10 to 30 inches
Thickness of the mollic epipedon: 10 to 20 inches

A horizon:

Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy sand
Content of rock fragments—0 to 10 percent

Bw horizon:

Hue—10YR
Value—3 or 4
Chroma—1 to 3
Texture—sand, loamy sand, loamy fine sand, or the gravelly analogs of these textures
Content of rock fragments—10 to 25 percent

C horizon:

Hue—10YR or 2.5Y
Value—4 to 7
Chroma—2 to 4
Texture—very gravelly coarse sand, very gravelly sand, gravelly coarse sand, gravelly sand, coarse sand, or sand
Content of rock fragments—averages between 10 and 35 percent; as much as 50 percent in some subhorizons

1874—Radium loamy sand**Composition**

Radium and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on beach plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy sand

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Beach deposits

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 3.7 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Rosewood and similar soils
- Hangaard and similar soils
- Marquette and similar soils
- Flaming and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Redby Series

Depth class: Very deep

Drainage class: Somewhat poorly drained

Permeability: Rapid

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 3 percent

Taxonomic classification: Mixed, frigid Aquic Udipsamments

Typical Pedon

Redby loamy fine sand, 1,500 feet south and 625 feet east of the northwest corner of sec. 12, T. 158 N., R. 39 W.

Ap—0 to 6 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; very friable; few very fine roots; slightly acid; abrupt smooth boundary.

E—6 to 13 inches; grayish brown (10YR 5/2) fine sand; common fine prominent dark yellowish brown (10YR 4/6) and few fine prominent dark brown (7.5YR 4/4) iron concentrations; single grain; loose; slightly acid; clear wavy boundary.

Bw1—13 to 21 inches; brown (10YR 5/3) fine sand; few medium prominent red (2.5YR 4/6), few fine distinct dark brown (7.5YR 4/4), and common fine distinct dark yellowish brown (10YR 4/6) iron concentrations; single grain; loose; neutral; gradual wavy boundary.

Bw2—21 to 36 inches; brown (10YR 5/3) fine sand; few fine prominent yellowish red (5YR 4/6), few fine distinct dark brown (7.5YR 4/4), and many medium distinct brownish yellow (10YR 6/6) iron concentrations and few fine distinct gray (10Y 5/1) iron depletions; single grain; loose; neutral; gradual wavy boundary.

C—36 to 60 inches; light brownish gray (2.5Y 6/2) fine sand; few fine prominent olive yellow (2.5Y 6/6) iron concentrations and few fine distinct gray (10Y 5/1) iron depletions; single grain; loose; 2 percent gravel; slightly effervescent; neutral.

Range in Characteristics

Depth to carbonates: 36 inches or more

A horizon:

Hue—10YR

Value—2 to 4

Chroma—1 or 2

Texture—loamy fine sand

E horizon:

Hue—10YR

Value—5 or 6

Chroma—2 or 3

Texture—fine sand or sand

Bw horizon:

Hue—10YR

Value—4 to 6

Chroma—3 or 4

Texture—fine sand or sand

C horizon:

Hue—10YR or 2.5Y

Value—5 to 7
 Chroma—2 or 3
 Texture—fine sand or sand
 Content of rock fragments—0 to 2 percent

116—Redby loamy fine sand

Composition

Redby and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1.5 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 4.8 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Cormant and similar soils
- Clearriver and similar soils
- Grygla and similar soils
- Strathcona and similar soils
- Eckvoll and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Reiner Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Lake plains
Parent material: Till
Slope range: 0 to 3 percent
Taxonomic classification: Fine-loamy, mixed, superactive Abruptic Udic Argiborolls

Typical Pedon

Reiner fine sandy loam, 1,900 feet north and 1,700 feet east of the southwest corner of sec. 6, T. 155 N., R. 40 W.

- Ap—0 to 9 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; common very fine roots; neutral; abrupt smooth boundary.
- Bt—9 to 16 inches; brown (10YR 4/3) clay loam; few medium distinct dark grayish brown (2.5Y 4/2) iron depletions; moderate fine subangular blocky structure; firm; few very fine roots; common very dark grayish brown (2.5Y 3/2) clay films on faces of peds; neutral; clear smooth boundary.
- Bk—16 to 32 inches; light brownish gray (2.5Y 6/2) loam; common medium distinct light yellowish brown (10YR 6/4) and few medium prominent brownish yellow (10YR 6/6) iron concentrations; weak medium subangular blocky structure; friable; common fine soft masses of carbonates; 2 percent cobbles; strongly effervescent; slightly alkaline; gradual smooth boundary.
- C—32 to 60 inches; light brownish gray (2.5Y 6/2) loam; few medium prominent light olive brown (2.5Y 5/6) and common medium distinct pale yellow (2.5Y 7/4) iron concentrations; massive with medium blocky soil fragments; friable; many fine soft masses of carbonates; 3 percent cobbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 13 to 22 inches
Thickness of the mollic epipedon: 7 to 16 inches
Other features: Some pedons have an E horizon.

A horizon:

Hue—10YR
 Value—2 or 3
 Chroma—1 or 2
 Texture—fine sandy loam or loamy fine sand

Bt horizon:

Hue—10YR or 2.5Y
 Value—3 to 5
 Chroma—2 to 4
 Texture—clay loam, sandy clay loam, or loam
 Content of rock fragments—0 to 5 percent

Bk horizon:

Hue—10YR or 2.5Y
 Value—4 to 6
 Chroma—2 to 4
 Texture—loam or clay loam
 Content of rock fragments—1 to 8 percent

C horizon:

Hue—2.5Y
 Value—5 or 6
 Chroma—2 to 4
 Texture—loam or clay loam
 Content of rock fragments—1 to 8 percent

649—Reiner loamy fine sand**Composition**

Reiner and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Kratka and similar soils
- Roliss and similar soils
- Smiley and similar soils
- Eckvoll and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

650—Reiner fine sandy loam**Composition**

Reiner and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 2.5 to 5.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Smiley and similar soils
- Kratka and similar soils
- Roliss and similar soils
- Pelan and similar soils
- Linveldt and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Reis Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Moderate to slow

Landform: Lake plains

Parent material: Till

Slope range: 0 to 2 percent

Taxonomic classification: Fine, smectitic, frigid Typic Calciaquerts

Typical Pedon

Reis clay loam, in an area of Clearwater-Reis complex, 275 feet south and 2,350 feet west of the northeast corner of sec. 31, T. 156 N., R. 42 W.

Ap—0 to 7 inches; black (N 2/0) clay loam, very dark gray (5Y 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; few fine carbonate coatings on faces of peds; 1 percent gravel; violently effervescent; moderately alkaline; abrupt wavy boundary.

Bkssg1—7 to 14 inches; olive gray (5Y 4/2) silty clay; common fine prominent light olive brown (2.5Y 5/6) iron concentrations; moderate fine angular blocky structure; firm; common fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 45 degrees above the horizontal; cracks 1/4 inch to 3 inches wide and 2 to 4 feet apart filled with material from the A horizon; common fine carbonate coatings on faces of peds; 2 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

Bkssg2—14 to 21 inches; olive gray (5Y 5/2) silty clay; many fine prominent dark olive brown (2.5Y 5/4) iron concentrations; moderate fine subangular blocky structure; firm; few fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks 1/4 inch to 2 inches wide and 2 to 4 feet apart filled with material from the A horizon; few fine carbonate coatings on faces of peds; 2 percent gravel; strongly effervescent; slightly alkaline; clear wavy boundary.

Bkssg3—21 to 30 inches; olive gray (5Y 5/2) clay; many medium prominent olive brown (2.5Y 4/4) iron concentrations; moderate medium angular blocky structure; firm; few fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks 1/4 to 1 inch wide and 3 to 4 feet apart filled with material from the A horizon; common soft masses of carbonates; 2 percent

gravel; strongly effervescent; slightly alkaline; clear wavy boundary.

Cg—30 to 60 inches; dark greenish gray (5GY 4/1) clay; common medium prominent olive brown (2.5Y 4/4) iron concentrations; massive with medium blocky soil fragments; firm; common soft masses of carbonates; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 12 inches

A horizon:

Hue—10YR, 2.5Y, or neutral

Value—2 or 3

Chroma—0 or 1

Texture—clay loam

Content of rock fragments—1 to 4 percent

Bkssg horizon:

Hue—2.5Y or 5Y

Value—3 to 5

Chroma—1 or 2

Texture—silty clay or clay

Content of rock fragments—2 to 8 percent

Cg horizon:

Hue—2.5Y, 5Y, or 5GY

Value—4 or 5

Chroma—1 or 2

Texture—clay or silty clay

Content of rock fragments—2 to 8 percent

Rifle Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Moderately rapid

Landform: Lake plains

Parent material: Organic materials

Slope range: 0 to 1 percent

Taxonomic classification: Euic Typic Borohemists

Typical Pedon

Rifle mucky peat, 700 feet north and 150 feet west of the southeast corner of sec. 4, T. 157 N., R. 39 W.

Oe1—0 to 6 inches; black (10YR 2/1) mucky peat; 70 percent fiber, 30 percent rubbed; weak thick platy structure; very friable; common very fine and fine roots; very strongly acid; clear smooth boundary.

Oe2—6 to 30 inches; very dark brown (10YR 2/2) mucky peat; 80 percent fiber, 40 percent rubbed; weak thin platy structure; very friable; common very fine roots; extremely acid; clear smooth boundary.

Oa—30 to 35 inches; black (10YR 2/1) muck; 40 percent fiber, 10 percent rubbed; weak thin platy structure; very friable; few very fine roots; strongly acid; clear smooth boundary.

O'e—35 to 60 inches; very dark brown (10YR 2/2) mucky peat; 60 percent fiber, 25 percent rubbed; massive; very friable; few very fine roots; very strongly acid.

Range in Characteristics

Thickness of the histic epipedon: Greater than 60 inches

Oe and O'e horizons:

Hue—10YR, 7.5YR, or 5YR

Value—2 or 3

Chroma—1 to 4

Texture—mucky peat

Oa horizon:

Hue—10YR

Value—2

Chroma—1

Texture—muck

541—Rifle mucky peat

Composition

Rifle and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains

Slope: 0 to 1 percent

Component Description

Surface layer texture: Mucky peat

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Organic materials

Flooding: None

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

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 31.8 inches

Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Tacoosh and similar soils
- Berner and similar soils
- Soils that contain more wood fragments
- Soils that are ponded

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Roliss Series

Depth class: Very deep

Drainage class: Poorly drained and very poorly drained

Permeability: Moderately slow or moderate

Landform: Lake plains

Parent material: Till

Slope range: 0 to 2 percent

Taxonomic classification: Fine-loamy, mixed, superactive, calcareous, frigid Typic Endoaquolls

Typical Pedon

Roliss loam, 300 feet south and 2,050 feet west of the northeast corner of sec. 24, T. 155 N., R. 45 W.

Ap—0 to 9 inches; black (N 2/0) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; few fine roots; 2 percent gravel; neutral; abrupt smooth boundary.

A—9 to 12 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine roots; 2 percent gravel; very slightly effervescent; slightly alkaline; clear wavy boundary.

Bg—12 to 17 inches; dark grayish brown (2.5Y 4/2) loam; few fine distinct dark yellowish brown (10YR 4/4) iron concentrations; weak fine subangular blocky structure; friable; few fine roots; 3 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

Bkg—17 to 26 inches; grayish brown (2.5Y 5/2) loam; many medium distinct light yellowish brown (2.5Y 6/4) and common fine prominent olive yellow (2.5Y 6/6) iron concentrations; weak fine subangular blocky structure; friable; many fine soft masses of carbonates; 7 percent gravel; strongly effervescent; slightly alkaline; gradual wavy boundary.

BC—26 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium distinct light olive brown (2.5Y 5/6) iron concentrations and common medium faint light gray (2.5Y 7/2) iron depletions; weak fine subangular blocky structure; friable; many fine soft masses of carbonates; 7 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches

Thickness of the mollic epipedon: 7 to 14 inches

Ap horizon:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 or 1

Texture—loam

Content of rock fragments—0 to 2 percent

Bg horizon:

Hue—2.5Y or 5Y

Value—3 to 5

Chroma—1 or 2

Texture—loam, fine sandy loam, or clay loam

Content of rock fragments—0 to 3 percent

Bkg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—2

Texture—loam or clay loam

Content of rock fragments—1 to 10 percent

BC horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—2 to 4

Texture—loam, silty clay loam, or clay loam

Content of rock fragments—1 to 10 percent

387—Roliss loam, depressional

Composition

Roliss and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains

Slope: 0 to 1 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Till

Flooding: None

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

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 10.5 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Strathcona and similar soils
- Hamre and similar soils
- Vallers and similar soils
- Berner and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

582—Roliss loam

Composition

Roliss and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 10.6 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this

map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Hamre and similar soils
- Kratka and similar soils
- Kittson and similar soils
- Smiley and similar soils
- Mavie and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

972—Roliss-Vallers complex

Composition

Roliss and similar soils: About 50 percent

Vallers and similar soils: About 40 percent

Inclusions: About 10 percent

Setting

Landform: Roliss—flats and swales on lake plains;

Vallers—slight rises on lake plains

Slope: 0 to 2 percent

Component Description

Roliss

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 10.5 inches

Organic matter content: High

Vallers

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 11.2 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Hamre and similar soils
- Hamerly and similar soils
- Kratka and similar soils
- Kittson and similar soils
- Smiley and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Rosewood Series

Depth class: Very deep

Drainage class: Poorly drained or very poorly drained

Permeability: Upper part—moderately rapid; lower part—rapid

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 2 percent

Taxonomic classification: Sandy, mixed, frigid Typic Calciaquolls

Typical Pedon

Rosewood fine sandy loam, 1,200 feet east and 300 feet south of the northwest corner of sec. 12, T. 157 N., R. 47 W.

Ap—0 to 12 inches; black (10YR 2/1) fine sandy loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; very friable; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg1—12 to 18 inches; dark gray (10YR 4/1) loamy fine sand; common medium faint grayish brown (2.5Y 5/2) iron depletions; weak fine subangular blocky structure; very friable; disseminated

carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg2—18 to 22 inches; grayish brown (2.5Y 5/2) loamy fine sand; common medium faint dark grayish brown (2.5Y 4/2) iron depletions and common fine prominent dark yellowish brown (10YR 4/6) iron concentrations; weak fine subangular blocky structure; very friable; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Cg—22 to 60 inches; light brownish gray (2.5Y 6/2) fine sand; common medium distinct light yellowish brown (2.5Y 6/4) and many medium prominent light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 14 inches

A horizon:

Hue—10YR, 2.5Y, or neutral

Value—2 or 3

Chroma—0 or 1

Texture—fine sandy loam

Bkg horizon:

Hue—10YR, 2.5Y, or 5Y

Value—4 to 6

Chroma—1 or 2

Texture—loamy fine sand, fine sand, or fine sandy loam

Cg horizon:

Hue—2.5Y or 5Y

Value—5 to 7

Chroma—2

Texture—fine sand or sand

712—Rosewood fine sandy loam

Composition

Rosewood and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 5.6 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Flaming and similar soils
- Deerwood and similar soils
- Strathcona and similar soils
- Northwood and similar soils
- Syrene and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1882—Rosewood, Strathcona, and Berner soils, seepy

Composition

Rosewood: Variable

Strathcona: Variable

Berner: Variable

Inclusions: About 10 percent

Setting

Landform: Toeslopes

Slope: Rosewood—0 to 2 percent; Strathcona—0 to 2 percent; Berner—0 to 1 percent

Component Description

Rosewood

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

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

Available water capacity to 60 inches or root-limiting layer: About 5.9 inches

Organic matter content: High

Strathcona

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Seasonal high water table: At the surface to 0.5 foot below the surface

Available water capacity to 60 inches or root-limiting layer: About 8.5 inches

Organic matter content: High

Berner

Surface layer texture: Muck

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Organic materials and glaciolacustrine deposits or till

Flooding: None

Seasonal high water table: At the surface to 0.5 foot below the surface

Available water capacity to 60 inches or root-limiting layer: About 14.3 inches

Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Karlstad and similar soils
- Radium and similar soils
- Sandberg and similar soils
- Deerwood and similar soils
- Seelyeville and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1966—Rosewood-Hamar complex

Composition

Rosewood and similar soils: About 55 percent

Hamar and similar soils: About 40 percent

Inclusions: About 5 percent

Setting

Landform: Rosewood—flats and slight rises on lake plains; Hamar—swales on lake plains

Slope: 0 to 2 percent

Component Description

Rosewood

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 5.3 inches

Organic matter content: High

Hamar

Surface layer texture: Loamy fine sand

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

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

Available water capacity to 60 inches or root-limiting layer: About 4.8 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Ulen and similar soils
- Strathcona and similar soils
- Northwood and similar soils
- Deerwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Rushlake Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Rapid

Landform: Beach ridges on lake plains

Parent material: Beach deposits

Slope range: 0 to 3 percent

Taxonomic classification: Mixed, frigid Aquic Udipsamments

Typical Pedon

Rushlake loamy sand, 550 feet south and 2,150 feet east of the northwest corner of sec. 7, T. 157 N., R. 43 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loamy sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

Bw—8 to 12 inches; dark brown (10YR 4/3) loamy sand, dark yellowish brown (10YR 4/4) dry; weak medium subangular blocky structure; loose; 1 percent gravel; neutral; abrupt smooth boundary.

C1—12 to 17 inches; dark grayish brown (10YR 4/2) gravelly loamy sand; single grain; loose; 23 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

C2—17 to 24 inches; dark grayish brown (10YR 4/2) gravelly sand; single grain; loose; 21 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

C3—24 to 42 inches; grayish brown (10YR 5/2) gravelly sand; common medium distinct light yellowish brown (2.5Y 6/4) and few fine distinct yellowish brown (10YR 5/6) iron concentrations and few fine distinct gray (10YR 5/1) iron depletions; single grain; loose; 17 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

C4—42 to 60 inches; light brownish gray (10YR 6/2) sand; common medium distinct light yellowish brown (2.5Y 6/4) and few fine distinct yellowish brown (10YR 5/6) iron concentrations and few fine distinct gray (10YR 5/1) iron depletions; single grain; loose; 7 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 11 to 36 inches

Thickness of the surface layer: 4 to 9 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loamy sand

Content of rock fragments—0 to 8 percent

Bw horizon:

Hue—10YR

Value—4

Chroma—3

Texture—loamy sand or sand

Content of rock fragments—1 to 10 percent

C horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 to 6

Texture—gravelly loamy sand, gravelly sand, gravelly coarse sand, coarse sand, sand, or loamy coarse sand

Content of rock fragments—5 to 35 percent

708—Rushlake loamy sand

Composition

Rushlake and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on beach plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy sand

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Beach deposits

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 4.0 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Deerwood and similar soils
- Syrene and similar soils
- Rosewood and similar soils
- Marquette and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Sahkahtay Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Upper part—moderate; lower part—rapid or very rapid

Landform: Beach deposits on lake plains

Parent material: Beach deposits

Slope range: 0 to 2 percent

Taxonomic classification: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Mollic Endoaqualfs

Typical Pedon

Sahkahtay sandy loam, 100 feet south and 1,200 feet west of the northeast corner of sec. 2, T. 157 N., R. 43 W.

A—0 to 4 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak medium granular structure; friable; common very fine roots; neutral; abrupt smooth boundary.

E—4 to 8 inches; dark grayish brown (10YR 4/2) loamy sand, light brownish gray (10YR 6/2) dry; few fine faint brown (10YR 5/3) iron concentrations; weak fine subangular blocky structure; loose; few very fine roots; 5 percent gravel; neutral; clear wavy boundary.

Btg—8 to 14 inches; dark grayish brown (10YR 4/2) sandy clay loam; common fine distinct yellowish brown (10YR 5/6) iron concentrations and common fine distinct gray (2.5Y 5/1) iron depletions; moderate fine angular blocky structure; firm; few fine roots; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; 5 percent gravel; neutral; gradual smooth boundary.

Cg1—14 to 18 inches; dark grayish brown (2.5Y 4/2) loamy coarse sand; few fine faint olive brown (2.5Y 4/4) iron concentrations and common fine distinct gray (2.5Y 5/1) iron depletions; weak fine subangular blocky soil fragments parting to single grain; very friable; few very fine roots; 10

percent gravel; slightly alkaline; gradual smooth boundary.

Cg2—18 to 30 inches; dark grayish brown (2.5Y 4/2) gravelly coarse sand; few fine distinct light olive brown (2.5Y 5/6) iron concentrations and few fine distinct gray (2.5Y 5/1) iron depletions; single grain; loose; 30 percent gravel; slightly effervescent; slightly alkaline; gradual smooth boundary.

Cg3—30 to 60 inches; grayish brown (2.5Y 5/2) gravelly coarse sand; few fine distinct light olive brown (2.5Y 5/6) iron concentrations and few fine distinct gray (2.5Y 5/1) iron depletions; single grain; loose; 30 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 14 to 30 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—sandy loam

Content of rock fragments—0 to 15 percent

E horizon:

Hue—10YR

Value—4 to 6

Chroma—2

Texture—loamy sand or sand

Content of rock fragments—2 to 7 percent

Btg horizon:

Hue—10YR or 2.5Y

Value—4

Chroma—2

Texture—sandy clay loam or sandy loam

Content of rock fragments—2 to 5 percent

Cg horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 or 3

Texture—gravelly coarse sand, gravelly sand, loamy coarse sand, or sand

Content of rock fragments—averages 10 to 35 percent; less than 10 percent or more than 35 percent in some subhorizons

1191—Sahkahtay sandy loam

Composition

Sahkahtay and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on beach plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Beach deposits

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 3.7 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Karlstad and similar soils
- Clearriver and similar soils
- Deerwood and similar soils
- Soils that have a till substratum

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Sandberg Series

Depth class: Very deep

Drainage class: Excessively drained

Permeability: Upper part—rapid; lower part—very rapid

Landform: Beach ridges on lake plains

Parent material: Beach deposits

Slope range: 1 to 6 percent

Taxonomic classification: Sandy, mixed Udorthentic Haploborolls

Typical Pedon

Sandberg loamy sand, 1 to 6 percent slopes, 1,250 feet north and 300 feet east of the southwest corner of sec. 30, T. 155 N., R. 44 W.

Ap—0 to 12 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; few fine roots; 5 percent gravel; neutral; abrupt smooth boundary.

Bw—12 to 17 inches; very dark brown (10YR 3/3) sand, dark yellowish brown (10YR 4/4) dry; single grain; loose; few fine roots; 10 percent gravel; slightly acid; clear wavy boundary.

C1—17 to 26 inches; brown (10YR 5/3) coarse sand; single grain; loose; few fine roots; 12 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

C2—26 to 39 inches; brown (10YR 5/3) very gravelly coarse sand; single grain; loose; 50 percent gravel; strongly effervescent; slightly alkaline; clear smooth boundary.

C3—39 to 60 inches; dark grayish brown (10YR 4/2) coarse sand; single grain; loose; 10 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 13 to 20 inches

Thickness of the mollic epipedon: 9 to 16 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loamy sand

Content of rock fragments—2 to 10 percent

Bw horizon:

Hue—10YR

Value—3 or 4

Chroma—3

Texture—sand or gravelly sand

Content of rock fragments—5 to 35 percent

C horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 or 3

Texture—very gravelly coarse sand, gravelly coarse sand, coarse sand, or sand

Content of rock fragments—5 to 35 percent; as much as 55 percent in some subhorizons

258B—Sandberg loamy sand, 1 to 6 percent slopes

Composition

Sandberg and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Beach ridges

Position on the landform: Summits and backslopes

Slope: 1 to 6 percent

Component Description

Surface layer texture: Loamy sand

Depth class: Very deep (more than 60 inches)

Drainage class: Excessively drained

Dominant parent material: Beach deposits

Flooding: None

Depth to the water table: Greater than 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 3.2 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Radium and similar soils
- Syrene and similar soils
- Soils that contain more gravel
- Hangaard and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Seelyeville Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Moderately slow to moderately rapid

Landform: Lake plains

Parent material: Organic materials

Slope range: 0 to 1 percent

Taxonomic classification: Euic Typic Borosaprists

Typical Pedon

Seelyeville muck, 2,300 feet south and 2,100 feet west of the northeast corner of sec. 13, T. 157 N., R. 46 W.

Oa—0 to 8 inches; black (10YR 2/1) muck; 30

percent fiber, 5 percent rubbed; weak fine granular structure; very friable; common very fine and fine roots; slightly acid; clear smooth boundary.

Oe—8 to 12 inches; very dark grayish brown (10YR 3/2) mucky peat; 40 percent fiber, 25 percent rubbed; weak thick platy structure; very friable; few very fine roots; moderately acid; clear smooth boundary.

O'a1—12 to 26 inches; black (10YR 2/1) muck; 25 percent fiber, 5 percent rubbed; weak thin platy structure; very friable; few very fine and fine roots; moderately acid; gradual wavy boundary.

O'a2—26 to 40 inches; black (10YR 2/1) muck; 20 percent fiber, 5 percent rubbed; weak fine subangular blocky structure; very friable; few very fine and fine roots; moderately acid; gradual wavy boundary.

O'a3—40 to 60 inches; black (10YR 2/1) muck; 15 percent fiber, trace rubbed; massive; very friable; few very fine and fine roots; moderately acid.

Range in Characteristics

Thickness of the histic epipedon: More than 60 inches

Oa horizon:

Hue—10YR or 7.5YR

Value—2 or 3

Chroma—1

Texture—muck

Oe horizon:

Hue—10YR

Value—3

Chroma—2

Texture—mucky peat

540—Seelyeville muck

Composition

Seelyeville and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains

Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Organic materials

Flooding: None

Seasonal high water table: 1.0 foot above to 0.5 foot below the surface

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 24.0 inches

Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Berner and similar soils
- Soils that are ponded
- Rifle and similar soils
- Lupton and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1031—Seelyeville muck, ponded

Composition

Seelyeville and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains

Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Organic materials

Flooding: None

Seasonal high water table: At the surface to 3 feet above the surface

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 24.0 inches

Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is

available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Cathro and similar soils
- Soils that have a mineral surface layer
- Soils that contain woody fragments
- Berner and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Skagen Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderate

Landform: Lake plains

Parent material: Till

Slope range: 0 to 3 percent

Taxonomic classification: Coarse-loamy, mixed, superactive, frigid Aquic Calciborolls

Typical Pedon

Skagen loam, 1,900 feet north and 900 feet west of the southeast corner of sec. 10, T. 157 N., R. 45 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark grayish brown (2.5Y 3/2) dry; moderate medium subangular blocky structure parting to moderate fine granular; friable; few fine carbonate concretions; 2 percent gravel; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—7 to 10 inches; grayish brown (2.5Y 5/2) gravelly loam; weak fine and medium subangular blocky structure; very friable; disseminated carbonates; 11 percent gravel; 4 percent cobbles; violently effervescent; moderately alkaline; clear smooth boundary.

2Bk2—10 to 14 inches; light brownish gray (2.5Y 6/2) loam; weak fine and medium subangular blocky structure; very friable; disseminated carbonates; 8 percent gravel; 4 percent cobbles; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk3—14 to 21 inches; light yellowish brown (2.5Y 6/4) loam; common fine and medium faint olive yellow (2.5Y 6/6) iron concentrations; weak fine and medium subangular blocky structure; very

friable; disseminated carbonates; 6 percent gravel; 4 percent cobbles; violently effervescent; moderately alkaline; clear smooth boundary.
 2Bw—21 to 60 inches; light yellowish brown (2.5Y 6/4) loam; common fine faint olive yellow (2.5Y 6/8) iron concentrations; weak fine and medium subangular blocky structure; very friable; 6 percent gravel; 4 percent cobbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 10 inches

A horizon:

Hue—10YR
 Value—2 or 3
 Chroma—1 or 2
 Texture—loam
 Content of rock fragments—2 to 5 percent gravel;
 0 to 10 percent cobbles

Bk horizon:

Hue—2.5Y
 Value—5
 Chroma—2
 Texture—gravelly loam or gravelly fine sandy loam
 Content of rock fragments—15 to 35 percent gravel; 0 to 10 percent cobbles

2Bk horizon:

Hue—10YR or 2.5Y
 Value—5 or 6
 Chroma—1 to 4
 Texture—loam, clay loam, sandy loam, fine sandy loam, or the gravelly analogs of these textures
 Content of rock fragments—5 to 15 percent gravel; 0 to 5 percent cobbles

2Bw horizon:

Hue—2.5Y
 Value—5 or 6
 Chroma—2 to 4
 Texture—loam, fine sandy loam, or the gravelly analogs of these textures
 Content of rock fragments—5 to 15 percent gravel; 0 to 5 percent cobbles

1158—Skagen loam

Composition

Skagen and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.8 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Percy and similar soils
- Strathcona and similar soils
- Radium and similar soils
- Foxhome and similar soils
- Soils that have a very cobbly surface layer

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1170—Skagen loam, very cobbly

Composition

Skagen and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Till

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 8.8 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Percy and similar soils
- Foxhome and similar soils
- Strandquist and similar soils
- Strathcona and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Smiley Series

Depth class: Very deep

Drainage class: Poorly drained or very poorly drained

Permeability: Moderately slow or moderate

Landform: Lake plains

Parent material: Till

Slope range: 0 to 2 percent

Taxonomic classification: Fine-loamy, mixed, superactive, frigid Typic Argiaquolls

Typical Pedon

Smiley loam, 200 feet north and 200 feet east of the southwest corner of sec. 28, T. 156 N., R. 39 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to moderate fine granular; friable; common fine and few medium roots; 2 percent gravel; neutral; abrupt smooth boundary.

Btg—9 to 16 inches; very dark gray (5Y 3/1) clay loam; moderate medium subangular blocky structure; friable; common fine and few medium roots; common distinct black (5Y 2.5/1) clay films on faces of peds; 2 percent gravel; neutral; gradual wavy boundary.

Bkg1—16 to 20 inches; olive gray (5Y 5/2) loam; common medium faint olive (5Y 5/3) iron concentrations; weak fine subangular blocky structure; friable; few fine roots; disseminated carbonates; 4 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bkg2—20 to 38 inches; olive gray (5Y 5/2) loam; many fine and medium prominent olive yellow (2.5Y 6/6) iron concentrations and many medium faint grayish brown (2.5Y 5/2) iron depletions; weak coarse subangular blocky structure; friable; common soft masses of carbonates; 7 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

Cg—38 to 60 inches; light olive gray (5Y 6/2) loam; many medium prominent olive yellow (2.5Y 6/6) iron concentrations and few fine distinct dark gray (5Y 4/1) iron depletions; massive with coarse blocky soil fragments; friable; common soft masses of carbonates; 7 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 11 to 20 inches

Thickness of the mollic epipedon: 7 to 16 inches

A horizon:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 to 2

Texture—loam or mucky loam

Content of rock fragments—2 to 5 percent

Btg horizon:

Hue—10YR, 2.5Y, or 5Y

Value—3 to 5

Chroma—1 or 2

Texture—clay loam, silty clay loam, or loam

Content of rock fragments—2 to 5 percent

Bkg horizon:

Hue—2.5Y or 5Y

Value—4 to 7

Chroma—2 to 4

Texture—loam or clay loam

Content of rock fragments—2 to 7 percent

Cg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—1 or 2

Texture—loam or clay loam

Content of rock fragments—2 to 7 percent

653—Smiley mucky loam, depressional**Composition**

Smiley and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Vallery and similar soils
- Kratka and similar soils
- Hamre and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

765—Smiley loam**Composition**

Smiley and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Reiner and similar soils
- Kratka and similar soils
- Vallery and similar soils
- Hamre and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Strandquist Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—rapid; lower part—moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Sandy-skeletal over loamy, mixed, superactive, calcareous, frigid Typic Endoaquolls

Typical Pedon

Strandquist loam, 950 feet north and 300 feet east of the southwest corner of sec. 10, T. 156 N., R. 39 W.

Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky

structure; very friable; common very fine roots; slightly alkaline; abrupt smooth boundary.

2Bg1—10 to 15 inches; dark grayish brown (2.5Y 4/2) very gravelly loamy coarse sand; few fine prominent light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; common very fine roots; 55 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.

2Bg2—15 to 30 inches; grayish brown (2.5Y 5/2) very gravelly coarse sand; common fine prominent brownish yellow (10YR 6/6) iron concentrations; single grain; loose; few very fine roots; 50 percent gravel; slightly effervescent; slightly alkaline; abrupt wavy boundary.

3Bg3—30 to 36 inches; grayish brown (2.5Y 5/2) loam; common fine distinct light yellowish brown (2.5Y 6/4) iron concentrations; weak fine subangular blocky structure; friable; common fine soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline; gradual smooth boundary.

3Cg—36 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium prominent light olive brown (2.5Y 5/6) iron concentrations; massive with fine blocky soil fragments; friable; common fine soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches

Thickness of the mollic epipedon: 7 to 12 inches

Depth to glacial till: 20 to 40 inches

A horizon:

Hue—10YR

Value—2

Chroma—1

Texture—loam

Content of rock fragments—0 to 10 percent

2Bg horizon:

Hue—10YR or 2.5Y

Value—4 or 5

Chroma—2

Texture—very gravelly coarse sand, very gravelly sand, gravelly coarse sand, gravelly sand, or very gravelly loamy coarse sand

Content of rock fragments—averages 35 to 75 percent

3Bg and 3Cg horizons:

Hue—2.5Y

Value—5 or 6

Chroma—2

Texture—loam

Content of rock fragments—3 to 10 percent

432—Strandquist loam

Composition

Strandquist and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 7.1 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Foxhome and similar soils
- Karlstad and similar soils
- Roliss and similar soils
- Northwood and similar soils
- Hangaard and similar soils
- Percy and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Strathcona Series

Depth class: Very deep

Drainage class: Poorly drained and very poorly drained

Permeability: Upper part—moderately rapid or rapid;
lower part—moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 2 percent

Taxonomic classification: Sandy over loamy, mixed,
superactive, frigid Typic Calciaquolls

Typical Pedon

Strathcona fine sandy loam (fig. 10), 1,650 feet south and 400 feet west of the northeast corner of sec. 2, T. 156 N., R. 44 W.

Ap—0 to 9 inches; black (N 2/0) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg—9 to 15 inches; dark gray (10YR 4/1) fine sandy loam; weak fine subangular blocky structure; very friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

2Bg1—15 to 21 inches; light brownish gray (2.5Y 6/2) fine sand; common coarse prominent brownish yellow (10YR 6/8) and few fine prominent strong brown (7.5YR 5/6) iron concentrations; single grain; loose; strongly effervescent; slightly alkaline; clear wavy boundary.

2Bg2—21 to 32 inches; light brownish gray (2.5Y 6/2) fine sand; common medium prominent olive yellow (2.5Y 6/6) and few fine prominent strong brown (7.5YR 5/6) iron concentrations; single grain; loose; strongly effervescent; moderately alkaline; clear wavy boundary.

3Cg—32 to 60 inches; grayish brown (2.5Y 5/2) loam; common medium prominent yellowish brown (10YR 5/8) iron concentrations and many fine faint light brownish gray (10YR 6/2) iron depletions; massive with medium blocky soil fragments; friable; few fine threads and soft masses of carbonates; 6 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 12 inches

Thickness of the sandy mantle: 20 to 40 inches

A horizon:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 or 1

Texture—fine sandy loam or mucky fine sandy loam

Bkg horizon:

Hue—10YR or 5Y

Value—4 to 6

Chroma—1 or 2

Texture—fine sandy loam, loamy fine sand, or fine sand

2Bg horizon:

Hue—2.5Y or 5Y

Value—5 to 7

Chroma—2

Texture—fine sand, loamy sand, or loamy fine sand

3Cg horizon:

Hue—2.5Y or 5Y

Value—5 to 7

Chroma—1 or 2

Texture—loam

Content of rock fragments—2 to 7 percent

439—Strathcona fine sandy loam

Composition

Strathcona and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 8.0 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Northwood and similar soils
- Grimstad and similar soils
- Vallers and similar soils

- Rosewood and similar soils
- Mavie and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1144—Strathcona and Kratka soils, depressional

Composition

Strathcona: Variable

Kratka: Variable

Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains

Slope: 0 to 1 percent

Component Description

Strathcona

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Seasonal high water table: 1.0 foot above to 0.5 foot below the surface

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 9.2 inches

Organic matter content: Very high

Kratka

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Seasonal high water table: 1.0 foot above to 0.5 foot below the surface

Ponding duration: Very long

Available water capacity to 60 inches or root-limiting layer: About 8.0 inches

Organic matter content: Very high

A typical soil series description with range in

characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Northwood and similar soils
- Roliss and similar soils
- Percy and similar soils
- Deerwood and similar soils
- Hamre and similar soils
- Rosewood and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Syrene Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Upper part—moderately rapid; lower part—rapid

Landform: Beach deposits on lake plains

Parent material: Beach deposits

Slope range: 0 to 2 percent

Taxonomic classification: Sandy, mixed, frigid Typic Calciaquolls

Typical Pedon

Syrene sandy loam, 200 feet south and 1,250 feet west of the northeast corner of sec. 9, T. 156 N., R. 46 W.

Ap—0 to 10 inches; black (N 2/0) sandy loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; few fine roots; 1 percent gravel; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg—10 to 19 inches; dark gray (5Y 4/1) fine sandy loam; common medium distinct dark grayish brown (2.5Y 4/2) and common fine faint gray (5Y 5/1) iron depletions; weak medium subangular blocky structure; very friable; few fine roots; disseminated carbonates; 1 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

2Cg1—19 to 25 inches; light brownish gray (2.5Y 6/2) fine sand; few fine prominent light olive brown

(2.5Y 5/6) iron concentrations; single grain; loose; 5 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

2Cg2—25 to 60 inches; light brownish gray (2.5Y 6/2) gravelly fine sand; many medium distinct light yellowish brown (2.5Y 6/4) and many fine and medium prominent yellowish brown (10YR 5/6) iron concentrations; single grain; loose; 30 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 12 inches

A horizon:

Hue—10YR or neutral

Value—2

Chroma—0 or 1

Texture—sandy loam

Content of rock fragments—0 to 10 percent

Bkg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—1 or 2

Texture—fine sandy loam, very fine sandy loam, or loam

Content of rock fragments—0 to 15 percent

2Cg horizon:

Hue—2.5Y

Value—5 or 6

Chroma—2 to 4

Texture—gravelly sand, gravelly fine sand, coarse sand, sand, or fine sand

Content of rock fragments—5 to 35 percent

435—Syrene sandy loam

Composition

Syrene and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on beach plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Beach deposits

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 4.3 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Radium and similar soils
- Grimstad and similar soils
- Mavie and similar soils
- Deerwood and similar soils
- Northwood and similar soils
- Rosewood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Tacoosh Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Upper part—moderate or moderately rapid; lower part—moderately slow or moderate

Landform: Lake plains

Parent material: Organic materials and till

Slope range: 0 to 1 percent

Taxonomic classification: Loamy, mixed, euic Terric Borohemists

Typical Pedon

Tacoosh muck, 100 feet north and 1,500 feet east of the southwest corner of sec. 4, T. 158 N., R. 40 W.

Oa—0 to 8 inches; black (10YR 2/1) muck; 70 percent fiber, 15 percent rubbed; weak thick platy structure parting to weak thin platy; very friable; very strongly acid; clear smooth boundary.

Oe1—8 to 21 inches; black (10YR 2/1) mucky peat; 90 percent fiber, 35 percent rubbed; weak thick platy structure parting to weak thin platy; friable; strongly acid; clear smooth boundary.

Oe2—21 to 29 inches; dark brown (7.5YR 3/2) mucky peat; 90 percent fiber, 35 percent rubbed; weak

- medium and coarse subangular blocky structure; friable; extremely acid; clear smooth boundary.
- Oe3—29 to 33 inches; black (10YR 2/1) mucky peat; 70 percent fiber, 20 percent rubbed; weak medium and coarse subangular blocky structure; very friable; extremely acid; clear smooth boundary.
- O'a—33 to 36 inches; black (10YR 2/1) muck; 40 percent fiber, 10 percent rubbed; weak fine and medium subangular blocky structure; very friable; extremely acid; abrupt smooth boundary.
- Cg1—36 to 40 inches; dark grayish brown (10YR 4/2) sandy loam; massive with fine blocky soil fragments; friable; common medium black (10YR 2/1) organic coatings on exteriors of blocky soil fragments; 10 percent gravel; strongly effervescent; slightly alkaline; clear wavy boundary.
- Cg2—40 to 60 inches; very dark gray (10YR 4/1) fine sandy loam; few fine distinct dark yellowish brown (10YR 4/6) iron concentrations; massive with medium blocky soil fragments; friable; few fine black (10YR 2/1) organic coatings on exteriors of blocky soil fragments; 3 percent gravel; violently effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 30 to 51 inches
Thickness of the histic epipedon: 16 to 50 inches

Oa horizon:

Hue—10YR
 Value—2
 Chroma—1
 Texture—muck

Oe horizon:

Hue—10YR or 7.5YR
 Value—2 or 3
 Chroma—1 or 2
 Texture—mucky peat

Cg horizon:

Hue—10YR or 2.5Y
 Value—4 to 6
 Chroma—1 or 2
 Texture—fine sandy loam, sandy loam, or loam
 Content of rock fragments—2 to 10 percent

514—Tacoosh muck

Composition

Tacoosh and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 18.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Rifle and similar soils
- Hamre and similar soils
- Northwood and similar soils
- Seelyville and similar soils

Major Uses of the Unit

- Wildlife habitat
- For general and detailed information concerning these uses, see Part II of this publication:
- Wildlife Habitat section

Thiefriver Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—moderately rapid; lower part—slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Sandy over clayey, mixed over smectitic, frigid Typic Calciaquolls

Typical Pedon

Thiefriver fine sandy loam, 2,000 feet south and 750 feet east of the northwest corner of sec. 9, T. 156 N., R. 42 W.

Ap—0 to 8 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; very friable; few fine roots; 3 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg1—8 to 15 inches; grayish brown (2.5Y 5/2) loamy fine sand; few fine prominent yellowish brown (10YR 5/8) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; disseminated carbonates; 2 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg2—15 to 31 inches; light brownish gray (2.5Y 6/2) loamy fine sand; common fine prominent olive yellow (2.5Y 6/6) iron concentrations; weak medium subangular blocky structure; very friable; disseminated carbonates; 1 percent gravel; strongly effervescent; slightly alkaline; abrupt wavy boundary.

2Cg—31 to 60 inches; dark gray (5Y 4/1) clay; few fine prominent light olive brown (2.5Y 5/6) and common fine prominent olive brown (2.5Y 4/4) iron concentrations; massive with fine blocky soil fragments; very firm; common fine soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 11 inches

Thickness of the sandy mantle: 20 to 40 inches

A horizon:

Hue—10YR, 2.5Y, or neutral

Value—2

Chroma—0 or 1

Texture—fine sandy loam

Content of rock fragments—1 to 5 percent

Bkg horizon:

Hue—2.5Y

Value—4 to 7

Chroma—1 or 2

Texture—loamy fine sand or fine sandy loam

Content of rock fragments—1 to 5 percent

2Cg horizon:

Hue—5Y

Value—4

Chroma—1 or 2

Texture—clay

Content of rock fragments—1 to 5 percent

651—Thief river fine sandy loam

Composition

Thief river and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 7.6 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Huot and similar soils
- Clearwater and similar soils
- Hilaire and similar soils
- Espelie and similar soils
- Rosewood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Ulen Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Rapid

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 3 percent

Taxonomic classification: Sandy, frigid, mixed Aeric
Calcicquolls

Typical Pedon

Ulen loamy fine sand (fig. 11), 750 feet north and 1,900 feet west of the southeast corner of sec. 23, T. 156 N., R. 47 W.

Ap—0 to 10 inches; black (10YR 2/1) loamy fine sand, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—10 to 17 inches; dark gray (10YR 4/1) loamy fine sand; weak medium subangular blocky structure; very friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—17 to 21 inches; dark grayish brown (10YR 4/2) loamy fine sand; weak medium subangular blocky structure; very friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear smooth boundary.

C1—21 to 27 inches; light yellowish brown (2.5Y 6/4) fine sand; few fine distinct light brownish gray (10YR 6/2) iron depletions; single grain; loose; slightly effervescent; slightly alkaline; clear smooth boundary.

C2—27 to 49 inches; light brownish gray (2.5Y 6/2) fine sand; common medium prominent olive yellow (2.5Y 6/6) and common fine prominent yellowish brown (10YR 5/8) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline; gradual wavy boundary.

C3—49 to 60 inches; light brownish gray (2.5Y 6/2) very fine sand; many medium prominent olive yellow (2.5Y 6/6) and common fine prominent light olive brown (2.5Y 5/6) iron concentrations and gray (10YR 5/1) iron depletions; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 16 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loamy fine sand

Bk horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—1 to 4

Texture—loamy fine sand, loamy sand, or fine sandy loam

C horizon:

Hue—10YR or 2.5Y

Value—5 or 6

Chroma—2 to 6

Texture—fine sand or loamy fine sand; subhorizons of very fine sand, sand, or coarse sand in some pedons

1264—Ulen loamy fine sand

Composition

Ulen and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains

Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 4.8 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Rosewood and similar soils
- Huot and similar soils
- Radium and similar soils
- Strathcona and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Vallers Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Moderately slow

Landform: Lake plains

Parent material: Till

Slope range: 0 to 2 percent

Taxonomic classification: Fine-loamy, mixed, superactive, frigid Typic Calciaquolls

Typical Pedon

Vallers loam, 1,000 feet south and 800 feet east of the northwest corner of sec. 11, T. 156 N., R. 44 W.

Ap—0 to 9 inches; black (N 2/0) loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; common very fine roots; 2 percent gravel; slightly effervescent; neutral; abrupt smooth boundary.

Bkg1—9 to 15 inches; light brownish gray (2.5Y 6/2) loam; few fine distinct gray (2.5Y 5/1) iron depletions and common fine distinct light olive brown (2.5Y 5/4) iron concentrations; weak very fine subangular blocky structure; friable; few very fine roots; disseminated carbonates; 1 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg2—15 to 26 inches; light brownish gray (2.5Y 6/2) loam; common medium distinct light yellowish brown (2.5Y 6/4) and few fine distinct light olive brown (2.5Y 5/4) iron concentrations; weak fine subangular blocky structure; friable; few very fine roots; few fine soft masses of carbonates; 4 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cg—26 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium distinct light yellowish brown (2.5Y 6/4) and common fine distinct light olive brown (2.5Y 5/4) iron concentrations; massive with fine blocky soil fragments; friable; few fine soft masses of carbonates; 6 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 12 inches

A horizon:

Hue—10YR, 5Y, or neutral

Value—2 or 3

Chroma—0 or 1

Texture—loam

Content of rock fragments—0 to 8 percent

Bkg horizon:

Hue—10YR, 2.5Y, or 5Y

Value—3 to 6

Chroma—1 or 2

Texture—loam, silty clay loam, or sandy clay loam

Content of rock fragments—1 to 5 percent

Cg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—2

Texture—loam or clay loam

Content of rock fragments—2 to 8 percent

236—Vallers loam**Composition**

Vallers and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 11.2 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Northwood and similar soils
- Kratka and similar soils
- Mavie and similar soils
- Grimstad and similar soils
- Hamre and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Wahpeton Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow or moderate
Landform: River terraces
Parent material: Alluvium
Slope range: 0 to 6 percent
Taxonomic classification: Fine, smectitic, frigid Typic Hapluderts

Typical Pedon

Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded, 800 feet north and 1,800 feet west of the southeast corner of sec. 8, T. 157 N., R. 50 W.

- Ap—0 to 9 inches; very dark gray (5Y 3/1) silty clay, dark gray (5Y 4/1) dry; strong fine and medium angular blocky structure; very firm; slightly alkaline; clear smooth boundary.
- Ass—9 to 22 inches; very dark grayish brown (2.5Y 3/2) silty clay, dark gray (5Y 4/1) dry; strong fine and medium angular blocky structure; very firm; common distinct slickensides on faces of peds; slightly alkaline; clear smooth boundary.
- Bss—22 to 35 inches; dark olive gray (5Y 3/2) silty clay, gray (5Y 5/1) dry; moderate thin and medium platy structure; very firm; common distinct slickensides; slightly alkaline; clear smooth boundary.
- C—35 to 60 inches; dark olive gray (5Y 3/2) silty clay, light gray (5Y 6/1) dry; massive with medium platy soil fragments; very firm; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 11 to 35 inches
Thickness of the mollic epipedon: 18 to 38 inches
Other features: An Ab horizon in some pedons; a Bk horizon in some pedons

A and Ass horizons:

Hue—10YR, 2.5Y, or 5Y
 Value—2 or 3
 Chroma—1 or 2
 Texture—silty clay

Bss and C horizons:

Hue—10YR, 2.5Y, or 5Y
 Value—3 to 5
 Chroma—1 or 2

Texture—silty clay, silty clay loam, or clay

157A—Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded

Composition

Wahpeton and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Flooding: Occasional
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Fargo and similar soils
- Northcote and similar soils
- Colvin and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

157B—Wahpeton silty clay, 2 to 6 percent slopes, occasionally flooded

Composition

Wahpeton and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Rises on flood plains and terraces

Slope: 2 to 6 percent

Component Description

Surface layer texture: Silty clay

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Alluvium

Flooding: Occasional

Depth to the water table: 2.5 to 3.5 feet

Available water capacity to 60 inches or root-limiting layer: About 9.2 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Fargo and similar soils
- Northcote and similar soils
- Colvin and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Wheatville Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Upper part—moderately rapid; lower part—slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 2 percent

Taxonomic classification: Coarse-silty over clayey, mixed over smectitic, superactive, frigid Aeric Calciaquolls

Typical Pedon

Wheatville very fine sandy loam, 0 to 2 percent slopes, 1,500 feet north and 300 feet east of the southwest corner of sec. 33, T. 157 N., R. 47 W.

Ap—0 to 9 inches; black (10YR 2/1) very fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few

very fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—9 to 14 inches; dark gray (10YR 4/1) very fine sandy loam; weak fine subangular blocky structure; very friable; few very fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—14 to 23 inches; light yellowish brown (2.5Y 6/4) loamy very fine sand; weak fine and medium subangular blocky structure; very friable; few very fine roots; strongly effervescent; slightly alkaline; gradual wavy boundary.

Bw—23 to 29 inches; light yellowish brown (2.5Y 6/4) loamy very fine sand; common medium prominent olive gray (5Y 5/2) iron depletions and common medium distinct light olive brown (2.5Y 5/6) iron concentrations; weak fine and medium subangular blocky structure; very friable; few very fine roots; slightly effervescent; slightly alkaline; abrupt wavy boundary.

2C—29 to 60 inches; dark grayish brown (2.5Y 4/2) clay; common fine faint grayish brown (2.5Y 5/2) iron depletions and common fine prominent yellowish brown (10YR 5/6) iron concentrations; massive with medium and fine blocky soil fragments; very firm; few soft masses of carbonates; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 14 inches

Thickness of the silty mantle: 20 to 40 inches

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—very fine sandy loam

Bk horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—1 to 4

Texture—loamy very fine sand or very fine sandy loam

Bw horizon:

Hue—2.5Y

Value—5 or 6

Chroma—4

Texture—loamy very fine sand, very fine sandy loam, or very fine sand

2C horizon:

Hue—2.5Y

Value—4 to 6
 Chroma—2
 Texture—clay, silty clay, silty clay loam, or clay loam

1315A—Wheatville very fine sandy loam, 0 to 2 percent slopes

Composition

Wheatville and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Very fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.9 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Augsburg and similar soils
- Clearwater and similar soils
- Ulen and similar soils
- Grimstad and similar soils
- Thiefriver and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Wildwood Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Slow

Landform: Lake plains
Parent material: Organic materials and glaciolacustrine deposits or till
Slope range: 0 to 1 percent
Taxonomic classification: Very fine, smectitic, nonacid, frigid Histic Humaquepts

Typical Pedon

Wildwood muck, 1,300 feet north and 175 feet west of the southeast corner of sec. 5, T. 155 N., R. 42 W.

Oa—0 to 9 inches; black (N 2/0) muck; 15 percent fiber rubbed; weak medium subangular blocky structure parting to weak fine granular; very friable; few very fine roots; strongly acid; abrupt smooth boundary.

A—9 to 12 inches; black (N 2/0) silty clay loam; few fine prominent dark brown (7.5YR 3/4) iron concentrations; weak fine subangular blocky structure; friable; few very fine roots; 3 percent gravel; neutral; clear wavy boundary.

Bg—12 to 18 inches; dark gray (5Y 4/1) clay; few fine prominent dark yellowish brown (10YR 4/6) iron concentrations and common fine distinct light olive gray (5Y 6/2) iron depletions; weak medium subangular blocky structure; firm; 3 percent gravel; slightly effervescent; neutral; clear wavy boundary.

Bkg—18 to 29 inches; olive gray (5Y 5/2) silty clay; few fine prominent light olive brown (2.5Y 5/6) iron concentrations and common fine faint dark gray (5Y 4/1) iron depletions; weak medium subangular blocky structure; firm; common fine soft masses of carbonates; 4 percent gravel; strongly effervescent; slightly alkaline; clear wavy boundary.

Cg—29 to 60 inches; olive gray (5Y 5/1) silty clay; few fine prominent light olive brown (2.5Y 5/6) iron concentrations and common fine faint dark gray (5Y 4/1) iron depletions; massive with medium blocky soil fragments; firm; few fine soft masses of carbonates; 3 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 12 to 19 inches
Thickness of the histic epipedon: 8 to 16 inches

Oa horizon:
 Hue—5Y or neutral
 Value—2
 Chroma—0 or 1
 Texture—muck

A horizon:
 Hue—10YR or neutral

Value—2
 Chroma—0 or 1
 Texture—silty clay loam or silty clay
 Content of rock fragments—2 to 3 percent

Bg and Bkg horizons:

Hue—5Y, 2.5Y, or 10YR
 Value—3 to 5
 Chroma—1 or 2
 Texture—clay or silty clay
 Content of rock fragments—2 to 4 percent

Cg horizon:

Hue—5Y, 2.5Y, or 10YR
 Value—3 to 5
 Chroma—1 or 2
 Texture—silty clay, clay, or clay loam
 Content of rock fragments—2 to 4 percent

630—Wildwood muck**Composition**

Wildwood and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits or till
Flooding: None
Seasonal high water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 4.6 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Thiefriver and similar soils
- Dora and similar soils

- Soils that are ponded
- Reis and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1188—Wildwood muck, ponded**Composition**

Wildwood and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits or till
Flooding: None
Seasonal high water table: At the surface to 2 feet above the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 6.5 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Dora and similar soils
- Soils that have a mineral surface layer

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Wyandotte Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Upper part—moderate; next part—rapid; lower part—slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 2 percent

Taxonomic classification: Sandy-skeletal over clayey, mixed over smectitic, frigid Typic Calciaquolls

Typical Pedon

Wyandotte clay loam, 300 feet east and 300 feet south of the northwest corner of sec. 12, T. 154 N., R. 44 W.

Ap—0 to 8 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; 2 percent gravel; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg1—8 to 15 inches; dark gray (10YR 4/1) loam; weak medium subangular blocky structure; friable; few fine roots; disseminated carbonates; 2 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

2Bkg2—15 to 29 inches; grayish brown (2.5Y 5/2) very gravelly coarse sand; few medium prominent light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; few fine roots; 60 percent gravel; strongly effervescent; slightly alkaline; clear wavy boundary.

3Cg—29 to 60 inches; olive gray (5Y 4/2) clay; common medium distinct olive (5Y 5/4) iron concentrations; weak medium subangular blocky structure; firm; few very fine roots; common fine soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 12 inches

Depth to clayey lacustrine sediments: 20 to 40 inches

A horizon:

Hue—10YR

Value—2

Chroma—1

Texture—clay loam

Content of rock fragments—2 to 5 percent

Bkg horizon:

Hue—10YR

Value—4

Chroma—1

Texture—loam

Content of rock fragments—2 to 5 percent

2Bkg horizon:

Hue—2.5Y

Value—5 or 6

Chroma—2

Texture—very gravelly coarse sand or very gravelly sand

Content of rock fragments—35 to 60 percent

3Cg horizon:

Hue—5Y

Value—4 or 5

Chroma—1 or 2

Texture—clay or silty clay

Content of rock fragments—3 to 5 percent

652—Wyandotte clay loam

Composition

Wyandotte and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 1 to 3 feet

Available water capacity to 60 inches or root-limiting layer: About 6.0 inches

Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Foxhome and similar soils
- Hilaire and similar soils
- Clearwater and similar soils
- Espelie and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

This page intentionally left blank.

References

- American Association of State Highway and Transportation Officials (AASHTO). 1986. Standard specifications for highway materials and methods of sampling and testing. 14th edition, 2 volumes.
- American Society for Testing and Materials (ASTM). 1993. Standard classification of soils for engineering purposes. ASTM Standard D 2487.
- Arndt, B. Michael. 1977. Stratigraphy of offshore sediment, Lake Agassiz, North Dakota. North Dakota Geological Survey, Report of Investigation 60.
- Hobbs, Howard C., and Joseph E. Goebel. 1982. Geologic map of Minnesota—Quaternary geology. U.S. Geological Survey.
- Minnesota Agricultural Statistics Service. 1991. Minnesota agriculture statistics. U.S. Department of Agriculture and Minnesota Department of Agriculture.
- Minnesota Soil and Water Conservation District. 1986. Windbreaks. Minnesota Tree Handbook.
- Nikiforoff, C.C. 1939. Soil survey (reconnaissance) of the Red River Valley Area, Minnesota. Bureau of Chemistry and Soils, Soil Survey Division, Series 1933, number 25.
- United States Department of Agriculture. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.
- United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conservation Service, U.S. Department of Agriculture Handbook 436.
- United States Department of Agriculture. 1993. Soil survey manual. U.S. Department of Agriculture Handbook 18.
- Wright, H.E., Jr. 1972. Quaternary history of Minnesota. *In* Geology of Minnesota: A centennial volume. Minnesota Geological Survey, pp. 515-547.

This page intentionally left blank.

Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Aspect. The direction in which a slope faces.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillslopes. Backslopes in profile

are commonly steep and linear and descend to a footslope. In terms of gradational process, backslopes are erosional forms produced mainly by mass wasting and running water.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

- Calcareous soil.** A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.
- California bearing ratio (CBR).** The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.
- Canopy.** The leafy crown of trees or shrubs. (See Crown.)
- Capillary water.** Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.
- Catena.** A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.
- Cation.** An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.
- Cation-exchange capacity.** The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.
- Catsteps.** Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.
- Channery soil material.** Soil material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.
- Chemical treatment.** Control of unwanted vegetation through the use of chemicals.
- Chiseling.** Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.
- Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
- Clay depletions.** Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.
- Clay film.** A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.
- Climax plant community.** The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.
- Coarse textured soil.** Sand or loamy sand.
- Cobble (or cobblestone).** A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.
- Cobbly soil material.** Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.
- Colluvium.** Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.
- Complex slope.** Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.
- Complex, soil.** A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.
- Compressible (in tables).** Excessive decrease in volume of soft soil under load.
- Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.
- Conservation cropping system.** Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the

soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the surface after planting in order to reduce the hazard of water erosion; in areas where wind erosion is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or its equivalent during the critical erosion period.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a “wire” when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming).

Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure,

organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. The thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained.—These soils have an intermediate or high water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of

most field crops are affected. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted under natural conditions. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poor drainage is caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except for rice) under natural conditions.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated

layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. The term is more often applied to cliffs resulting from differential erosion.

Esker. A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry

weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is generally a constructional landform consisting of sediment deposited during overflow and lateral migration of the stream.

Footslope. The geomorphic component that forms the inner, gently inclined surface at the base of a hillslope. The surface is dominantly concave. In terms of gradational processes, a footslope is a transition zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil

moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Geomorphology. The science that treats the general configuration of the earth's surface; specifically the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying structures, and the history of geologic changes as recorded by these surface features. The term is especially applied to the genetic interpretation of landforms.

Glacial drift. Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-chroma zones. Zones having chroma of 3 or more. Typical color in areas of iron concentrations.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 6 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive

characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Ice-walled lake plain. A relict surface marking the floor of an extinct lake basin that was formed on solid ground and surrounded by stagnant ice in a stable or unstable superglacial environment on stagnation moraines. As the ice melted, the lake plain became perched above the adjacent landscape. The lake plain is well sorted, generally fine textured, stratified deposits.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally,

material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Iron concentrations. High-chroma zones having a high content of iron and manganese oxide because of chemical oxidation and accumulation, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic concentration.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame. An irregular, short ridge or hill of stratified glacial drift.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake bed. The bottom of a lake; a lake basin.

Lake plain. A nearly level surface marking the floor of an extinct lake filled by well-sorted, generally fine-textured, stratified deposits, commonly containing varves.

Lakeshore. A narrow strip of land in contact with or bordering a lake; especially the beach of a lake.

Lake terrace. A narrow shelf, partly cut and partly built, produced along a lake shore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches

- (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.
- Leaching.** The removal of soluble material from soil or other material by percolating water.
- Liquid limit.** The moisture content at which the soil passes from a plastic to a liquid state.
- Loam.** Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.
- Loess.** Fine grained material, dominantly of silt-sized particles, deposited by wind.
- Low-chroma zones.** Zones having chroma of 2 or less. Typical color in areas of iron depletions.
- Low-residue crops.** Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.
- Low strength.** The soil is not strong enough to support loads.
- Marl.** An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.
- Masses.** Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.
- Mechanical treatment.** Use of mechanical equipment for seeding, brush management, and other management practices.
- Medium textured soil.** Very fine sandy loam, loam, silt loam, or silt.
- Metamorphic rock.** Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.
- Mineral soil.** Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.
- Minimum tillage.** Only the tillage essential to crop production and prevention of soil damage.
- Miscellaneous area.** An area that has little or no natural soil and supports little or no vegetation.
- Moderately coarse textured soil.** Coarse sandy loam, sandy loam, or fine sandy loam.
- Moderately fine textured soil.** Clay loam, sandy clay loam, or silty clay loam.
- Mollic epipedon.** A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.
- Moraine.** An accumulation of glacial drift in a topographic landform resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.
- Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.
- Mottling, soil.** Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).
- Muck.** Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)
- Mudstone.** Sedimentary rock formed by induration of silt and clay in approximately equal amounts.
- Munsell notation.** A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.
- Neutral soil.** A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)
- Nodules.** Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.
- Nutrient, plant.** Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.
- Organic matter.** Plant and animal residue in the soil

in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. An extensive area of glaciofluvial material that was deposited by meltwater streams.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

Pedon. The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Extremely slow	less than 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth).

Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in

reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	less than 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical

means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables). Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone.

formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The hillslope position that forms the uppermost inclined surface near the top of a hillslope. It comprises the transition zone from backslope to summit. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of

blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of

the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of rock fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter or loosen a layer that restricts roots.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summit. The topographically highest position of a hillslope profile and exhibiting a nearly level surface. A general term for the top, or highest level of a landform, such as a hill, mountain, or tableland. It usually refers to a high interfluvial area of gentler slope that is flanked by steeper hillslopes, for example, mountain fronts or tableland escarpments.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters).

Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Swale. A slight depression in the midst of generally level land. A shallow depression in an undulating ground moraine due to uneven glacial deposition.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Till plain. An extensive area of nearly level to undulating or gently sloping soils that are underlain by till or consist of till. Slopes are 0 to 6 percent.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as salts, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded

glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.