Series 1955, No. 4

Issued October 1959

SOIL SURVEY

Scott County Minnesota

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
MINNESOTA AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of Scott County will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; aid foresters in managing woodlands; and add to the soil scientist's fund of knowledge.

In making this survey, soil scientists walked over the fields and woodlands. They dug holes and examined surface soils and subsoils; measured slopes with a hand level; noticed differences in growth of crops, weeds, and brush; and, in fact, recorded all the things about the soils that they believed might affect their suitability for farming, engineering, forestry, and related uses.

The scientists plotted the boundaries of the soils on aerial photographs. Then, cartographers prepared from the photographs the detailed soil map in the back of this report. Fields, woods, roads, and many other landmarks can be seen on the map.

Locating the soils

Use the index to map sheets to locate areas on the large map. The index is a small map of the county numbered to show where each sheet of the large map is located. When the correct sheet of the large map is found, it will be seen that boundaries of the soils are outlined, and that there is a symbol for each kind of soil. All areas marked with the same kind of symbol are the same kind of soil, wherever they appear on the map. Suppose, for example, an area located on the map has a symbol CoB. The legend for the detailed map shows that this symbol identifies Clarion silt loam, 2 to 6 percent slopes. This soil, and all the others mapped in the county, are described in the section, Soils of Scott County.

Finding information

Few readers will be interested in all of the soil report, for it has special sections for different groups. The section, General Nature of the County, will be of interest mainly to those not familiar with the county. It mentions climate and physiography and gives some statistics on agriculture.

Farmers and those who work with farmers can learn about the soils in the section, Soils of Scott County, and then turn to the section, Use and Management of Soils. In this manner they first identify the soils on their farm and then learn how these soils can be managed and what yields can be expected. The soils are placed in management groups; that is, groups of soils that need similar management and respond in about the same way. For example, in the section on soil descriptions, Clarion silt loam, 2 to 6 percent slopes, is shown to be in management group 2. Therefore, the management this soil needs will be stated under the heading, Management Group 2, in the section, Use and Management of Soils.

Foresters and others interested in management of woodlands can refer to the subsection, General Management for Pasture, Woodland, and Wildlife Areas.

Engineers will want to refer to the section on engineering for information on characteristics of the soils to be considered in the building of roads, ponds, and similar structures.

Soil scientists will find information about how the soils were formed and how they were classified in the section, How Scott County Soils Were Formed and Classified.

Fieldwork for this survey was completed in 1955. Unless otherwise indicated, all statements in the report refer to conditions in the county at that time.

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SOIL SURVEY OF SCOTT COUNTY, MINNESOTA

Soils surveyed by JOSEPH F. CUMMINS, RUSSELL J. EDWARDS, H. KENT FRANCIS, G. F. HARMS, EDWARD R. MEIER, M. L. KORPI, and ALEX S. ROBERTSON, Soil Conservation Service

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United States Department of Agriculture in cooperation with University of Minnesota Agricultural Experiment Station

SCOTT COUNTY is in the south-central part of Minnesota (fig. 1). Shakopee, the county seat, is 25 airline miles southwest of St. Paul, the State Capital. The county has a total land area of approximately 352 square miles. Of this, about 94 percent is land in farms. Corn, oats, hay, and soybeans are the principal crops. Cattle far outnumber all other livestock, and nearly half the farms are dairy farms. Sale of livestock and livestock products accounts for about 87 percent of the income from farm products sold.

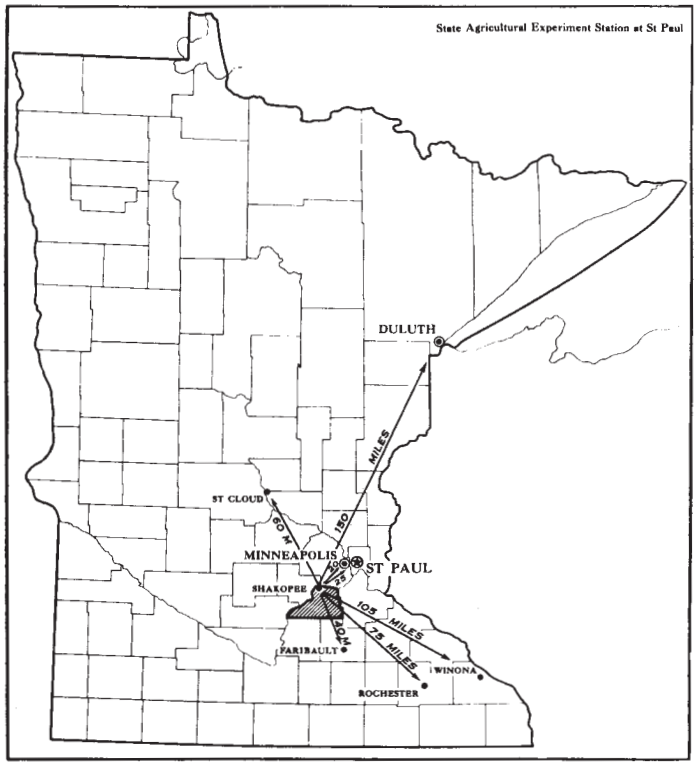

Figure 1.—Location of Scott County in Minnesota.

This survey was made cooperatively by the United States Department of Agriculture and the Minnesota Agricultural Experiment Station to provide a basis for determining the best agricultural uses of the land. In preparation of this soil survey, valuable assistance was received from the Scott County Agricultural Extension Service, Minnesota Department of Conservation, Lake States Forest Experiment Station, U. S. Bureau of Public Roads, and Minnesota Highway Department.

Soil Associations

The soils of Scott County will be more easily understood and remembered if they are first studied as they occur in broad areas, or soil associations. A soil association is a geographic pattern of defined and named kinds of soils (*7*).[1] The soils in an association may be much alike or entirely different, but the pattern in which the soils occur is fairly uniform.

The soils of this county have been placed in seven soil associations. These are shown on the small colored map at the back of this report. The associations are named for the major soils in them, but other soils may be present in any of the associations. Therefore, the reader will need to refer to the section, Soils of Scott County, for specific information concerning the soils shown on the detailed soil map at the back of this report.

Webster-LeSueur-Clarion-Lester Association

This soil association consists of nearly level to gently sloping soils that together occupy an area of approximately 54 square miles. These are glacially derived upland soils, very dark to moderately dark in color, and mostly of moderately fine texture. They range from well drained to very poorly drained but are predominately moderately well drained and poorly drained. These soils make excellent cropland if good farming is practiced and necessary drainage is installed. Some problems encountered in management are the need for tile drainage; the necessity for converting some areas to more intensive use; and the difficulty in maintaining soil tilth and productivity.

[1] Italic numbers in parentheses refer to Literature Cited, p. 91.

Large tracts of nearly level land still remain in pasture or woods (fig. 2).

Figure 2.—**Pasture and trees on Webster-LeSueur-Clarion-Lester soil association. These soils can be drained and used as rotation cropland. Capability class II.**

Lester-Webster-Glencoe Association

This soil association, the largest in the county, consists of rolling to nearly level soils that occupy an area of approximately 106 square miles. Slopes are ordinarily short and irregular. The soils are mostly moderately dark colored and medium textured, and they are located on uplands. They were derived from calcareous, moderately fine textured glacial material.

The soils in this association generally make good cropland. The drainage, for the most part, is good, although depressions and drainageways are poorly to very poorly drained. Most of the larger depressions are occupied by peat bogs, marshes, or lakes. The management problems are erosion, insufficient drainage, and difficulty of maintaining soil tilth and productivity.

Hayden-Lester-Peat Bogs Association

This soil association is on rolling to strongly rolling morainic glacial upland. It consists of well-drained, light-colored soils on the high ground and low wet soils in the depressions. There are many short, irregular slopes. The association occupies approximately 83 square miles.

The Hayden soils are light-colored, medium-textured, well-drained soils of the uplands that were derived from calcareous, moderately fine textured glacial material. Poorly and very poorly drained fine-textured soils occur in the drainageways and smaller depressions. Peat bogs, marshes, and lakes occupy the larger depressions.

The soils on the more gentle slopes are generally good for crops if properly farmed. Problems encountered in management are moderate to severe water erosion; necessity for adjustments in land use; need for drainage of small wet areas; and the low organic-matter content in the Hayden soils.

Burnsville-Hayden-Kingsley-Scandia Association

This association consists of steep and hilly loamy and sandy soils that together occupy an area of approximately 43 square miles. There are steep bluffs dividing the uplands from the terraces or bottom lands, some prominent morainic hills, and small very poorly drained depressions with many small lakes or ponds. The soils in this association are light colored and were derived from medium to moderately coarse textured glacial materials.

Pasture and woods occupy much of this association. If properly farmed, the areas on gentler slopes make fair cropland. Problems encountered in management are serious erosion on the cultivated areas; drought on the gravelly soils; stones and boulders that interfere with cropping or pasture renovation; overgrazing of pasture; poor management of woodlands; and necessity for water disposal along the bluffs.

Hubbard-Estherville-Dakota-Waukegan-Zimmerman Association

This soil association consists of level and gently sloping loamy and sandy soils on terraces. The soils together occupy an area of approximately 40 square miles. They occur on stratified sand-and-gravel terraces formed by glacial melt water. The deposits of sand and gravel range from a few inches to 40 or 50 feet deep. The stronger slopes are between terrace levels or between terraces and bottom lands.

Soils in this association are dark colored, except for the Zimmerman, which is light colored. In texture the surface soils range from medium (silt loam) to coarse (sand). Drainage ranges from good to excessive.

Rated as cropland, the soils range from very good on the deep silts (3 to 4 feet of silty material over sand and gravel) to very poor on the sands. Problems encountered in management are wind erosion, droughtiness, low inherent fertility (on gravelly and sandy soils), and need for conversion of unprofitable cropland to pine forests.

Copas-Faxon Association

This soil association consists mainly of rocky, shallow soils on terraces. It occupies an area of approximately 7 square miles. The topography ranges from nearly level to rough, irregular, and moundlike. Drainage is poor to very poor on the low, level areas, but the higher or more sloping areas are well drained, or excessively drained in many places. The underlying bedrock, a few inches to 3 feet below the surface, consists of limestone, sandstone, and sandstone capped by a few inches of weathered limestone.

Little of this soil association is suitable for crops; most of it is in pasture or woods. The problems encountered in management are droughtiness of the shallow soils; excessive wetness caused by a high water table; and clearing the land of numerous boulders.

Dorchester-Oshawa-Mixed Alluvium Association

This soil association consists of nearly level soils on flood plains that together occupy an area of approximately 19 square miles. The soils are located along the Minnesota River. They are moderately dark to light colored and medium to moderately coarse in texture. Drainage is very poor nearest the uplands or terraces and is progressively better toward the river channel. Problems encountered in management are flooding and poor drainage.

Soils of Scott County

This soil association consists of nearly level soils information about soils. It describes the soil series, or groups of soils similar in characteristics, and the single soils, or mapping units. For more generalized information, the reader can refer to the section, Soil Associations, where the broad geographic patterns of soils are explained.

The soils of the county are described in alphabetic order by series name. First there is a description of the soil series, and then a description of each soil in the series. All the soils of a series that have the same texture in the surface soil are described in sequence. For example, all the Estherville soils that have a gravelly sandy loam surface soil are described, and then, all the Estherville soils that have a loam to sandy loam surface layer.

Ordinarily, only one soil is described in detail for each kind of surface-soil texture. An important part of this detailed description is the soil profile, a record of what the soil scientist saw and learned when he dug into the ground. It is to be assumed that all the other soils having a surface layer of the same texture will have essentially the same kind of profile as that described for the first soil. To illustrate, a detailed profile is described for Hubbard fine sand, 0 to 2 percent slopes, and the reader is to conclude that all the other Hubbard fine sands have essentially this kind of profile. The differences, if any, are explained.

The acreage and proportionate extent of the soils are given in table 1. At the end of the description of each soil is the management group in which it has been placed. The management suggested for each group will be found in the section, Use and Management of Soils. The glossary defines many terms used in describing soils.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Proportionate extent	Soil	Area	Proportionate extent
	Acres	*Percent*		*Acres*	*Percent*
Alluvial land, 0 to 2 percent slopes	2,493	1.1	Clarion soils, 6 to 12 percent slopes, severely eroded	29	(1)
Alluvial land, 2 to 6 percent slopes	823	.4	Comfrey silty clay loam	1,557	0.7
Alluvial land, frequent overflow, 0 to 6 percent slopes	5,785	2.5	Copas silt loam, 0 to 2 percent slopes	1,277	.5
Beach materials, sandy	278	.1	Copas silt loam, 2 to 6 percent slopes	313	.1
Beach materials and Muck	260	.1	Copas silt loam, 2 to 6 percent slopes, moderately eroded	86	(1)
Blue Earth silty clay loam, 0 to 3 percent slopes	1,162	.5	Dakota loam, 0 to 2 percent slopes	1,309	.6
Burnsville, Hayden, Kingsley, and Scandia loams, 0 to 6 percent slopes	156	.1	Dakota loam, 2 to 6 percent slopes	155	.1
Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes	112	(1)	Dakota loam, 2 to 6 percent slopes, moderately eroded	131	(1)
Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes, moderately eroded	191	.1	Dakota loam, 6 to 12 percent slopes, moderately eroded	26	(1)
Burnsville, Hayden, Kingsley, and Scandia loams, 12 to 18 percent slopes	160	.1	Dakota sandy loam, 0 to 2 percent slopes	1,531	.7
Burnsville, Hayden, Kingsley, and Scandia loams, 12 to 18 percent slopes, moderately eroded	171	.1	Dakota sandy loam, 2 to 6 percent slopes	556	.2
Burnsville, Hayden, Kingsley, and Scandia loams, 18 to 25 percent slopes, slightly and moderately eroded	1,135	.5	Dakota sandy loam, 2 to 6 percent slopes, moderately eroded	203	.1
Burnsville, Hayden, Kingsley, and Scandia loams, 25 to 50 percent slopes	71	(1)	Dakota sandy loam, 6 to 12 percent slopes, moderately eroded	92	(1)
Burnsville, Hayden, Kingsley, and Scandia soils, 12 to 18 percent slopes, severely eroded	38	(1)	Dorchester loam and silt loam	207	.1
Burnsville, Hayden, Kingsley, and Scandia soils, 18 to 25 percent slopes, severely eroded	60	(1)	Dorchester silty clay loam	2,017	.9
Clarion silt loam, 2 to 6 percent slopes	4,705	2.0	Duelm fine sandy loam, 0 to 3 percent slopes	262	.1
Clarion silt loam, 2 to 6 percent slopes, moderately eroded	2,281	1.0	Dundas silt loam, 0 to 2 percent slopes	1,061	.5
Clarion silt loam, 6 to 12 percent slopes	121	(1)	Dune land	166	.1
Clarion silt loam, 6 to 12 percent slopes, moderately eroded	1,321	.6	Estherville loam and sandy loam, 0 to 2 percent slopes	2,209	.9
			Estherville loam and sandy loam, 2 to 6 percent slopes	615	.3
			Estherville loam and sandy loam, 2 to 6 percent slopes, moderately eroded	217	.1
			Estherville loam and sandy loam, 6 to 12 percent slopes	22	(1)
			Estherville loam and sandy loam, 6 to 12 percent slopes, moderately eroded	89	(1)
			Estherville gravelly sandy loam, 0 to 6 percent slopes	512	.2

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Proportionate extent
	Acres	*Percent*
Estherville gravelly sandy loam, 0 to 6 percent slopes, moderately eroded	138	0.1
Estherville gravelly sandy loam, 6 to 12 percent slopes	26	(1)
Estherville gravelly sandy loam, 6 to 12 percent slopes, moderately eroded	85	(1)
Faxon silty clay loam, 0 to 6 percent slopes	1,193	.5
Glencoe silty clay loam	7,939	3.4
Hayden loam, 0 to 6 percent slopes	4,826	2.1
Hayden loam, 2 to 6 percent slopes, moderately eroded	4,944	2.1
Hayden loam, 6 to 12 percent slopes	4,020	1.7
Hayden loam, 6 to 12 percent slopes, moderately eroded	10,404	4.5
Hayden loam, 12 to 18 percent slopes	3,028	1.3
Hayden loam, 12 to 18 percent slopes, moderately eroded	4,692	2.0
Hayden loam, 18 to 25 percent slopes, slightly and moderately eroded	3,971	1.7
Hayden loam, 25 to 35 percent slopes, slightly and moderately eroded	1,086	.5
Hayden sandy loam, 0 to 6 percent slopes	196	.1
Hayden sandy loam, 0 to 6 percent slopes, moderately eroded	231	.1
Hayden sandy loam, 6 to 12 percent slopes	494	.2
Hayden sandy loam, 6 to 12 percent slopes, moderately eroded	630	.3
Hayden sandy loam, 12 to 18 percent slopes	629	.3
Hayden sandy loam, 12 to 18 percent slopes, moderately eroded	401	.2
Hayden sandy clay loam, 12 to 18 percent slopes, severely eroded	170	.1
Hayden sandy loam, 18 to 25 percent slopes, slightly and moderately eroded	2,028	.9
Hayden sandy clay loam, 18 to 25 percent slopes, severely eroded	250	.1
Hayden sandy loam, 25 to 35 percent slopes, slightly and moderately eroded	182	.1
Hayden soils, 6 to 12 percent slopes, severely eroded	244	.1
Hayden soils, 12 to 18 percent slopes, severely eroded	1,947	.8
Hayden soils, 18 to 25 percent slopes, severely eroded	1,287	.6
Hubbard fine sand, 0 to 2 percent slopes	1,764	.8
Hubbard fine sand, 2 to 6 percent slopes	1,521	.7
Hubbard fine sand, 2 to 6 percent slopes, moderately wind eroded	404	.2
Hubbard fine sand, 6 to 12 percent slopes	199	.1
Hubbard fine sand, 6 to 12 percent slopes, moderately wind eroded	238	.1
Hubbard loamy fine sand, 0 to 2 percent slopes	877	.4
Hubbard loamy fine sand, 2 to 6 percent slopes	1,193	.5
Hubbard loamy fine sand, 2 to 6 percent slopes, moderately wind eroded	215	.1
Hubbard loamy fine sand, 6 to 12 percent slopes	30	(1)
Hubbard loamy fine sand, 6 to 12 percent slopes, moderately eroded	148	.1
Isanti fine sandy loam	349	.1
Kasota silt loam, 0 to 2 percent slopes	1,605	.7
Kasota silt loam, 2 to 6 percent slopes	75	(1)
Lakeville loam, 0 to 2 percent slopes	252	.1
Lakeville loam, 2 to 6 percent slopes	568	.2
Lakeville loam, 2 to 6 percent slopes, moderately eroded	418	.2
Lakeville loam, 6 to 12 percent slopes	75	(1)
Lakeville loam, 6 to 12 percent slopes, moderately eroded	456	.2
Lakeville loam, 12 to 18 percent slopes	86	(1)
Lakeville loam, 12 to 18 percent slopes, moderately eroded	142	0.1
Lakeville-Burnsville gravelly sandy loams, 0 to 6 percent slopes	118	(1)
Lakeville-Burnsville gravelly sandy loams, 0 to 6 percent slopes, moderately eroded	150	.1
Lakeville-Burnsville gravelly sandy loams, 6 to 12 percent slopes	135	.1
Lakeville-Burnsville gravelly sandy loams, 6 to 12 percent slopes, moderately eroded	522	.2
Lakeville-Burnsville gravelly sandy loams, 12 to 50 percent slopes	1,293	.6
Lester silt loam, 2 to 6 percent slopes	13,710	5.9
Lester silt loam, 2 to 6 percent slopes, moderately eroded	10,592	4.5
Lester silt loam, 6 to 12 percent slopes	2,530	1.1
Lester silt loam, 6 to 12 percent slopes, moderately eroded	10,485	4.5
Lester silt loam, 12 to 18 percent slopes	1,148	.5
Lester silt loam, 12 to 18 percent slopes, moderately eroded	2,016	.9
Lester silt loam, 18 to 25 percent slopes, slightly and moderately eroded	670	.3
Lester silt loam, 25 to 35 percent slopes, slightly and moderately eroded	354	.2
Lester soils, 6 to 12 percent slopes, severely eroded	243	.1
Lester soils, 12 to 18 percent slopes, severely eroded	1,022	.4
Lester soils, 18 to 25 percent slopes, severely eroded	195	.1
Lester soils, 25 to 35 percent slopes, severely eroded	37	(1)
LeSueur silt loam	394	.2
LeSueur-Lester silt loams	8,926	3.8
Marsh	5,414	2.3
Oshawa silty clay loam	603	.3
Peat and Muck, shallow, 0 to 2 percent slopes	3,769	1.6
Peat and Muck, shallow, 2 to 12 percent slopes	88	(1)
Peat, deep, 0 to 2 percent slopes	13,130	5.6
Peat, deep, 2 to 6 percent slopes	43	(1)
Rauville silty clay loam	969	.4
Sandstone outcrops	436	.2
Steep land, Hayden-Lester materials	4,206	1.8
Stony land	1,905	.8
Terrace escarpments	2,069	.9
Terril sandy loam, 0 to 6 percent slopes	49	(1)
Terril sandy loam, 6 to 12 percent slopes	152	.1
Terril sandy loam, 12 to 18 percent slopes	136	.1
Terril sandy loam, 18 to 25 percent slopes	18	(1)
Terril silt loam, 0 to 2 percent slopes	650	.3
Terril silt loam, 2 to 6 percent slopes	2,179	.9
Terril silt loam, 6 to 12 percent slopes	327	.1
Terril silt loam, 12 to 18 percent slopes	134	(1)
Terril silt loam, 18 to 25 percent slopes	7	(1)
Waukegan silt loam, 0 to 2 percent slopes	1,940	.8
Waukegan silt loam, 2 to 6 percent slopes	291	.1
Waukegan silt loam, 2 to 6 percent slopes, moderately eroded	62	(1)
Waukegan silt loam, 6 to 12 percent slopes, slightly and moderately eroded	27	(1)
Waukegan silt loam, 12 to 18 percent slopes, moderately eroded	19	(1)
Webster-Glencoe silty clay loams	17,774	7.6
Webster-LeSueur silty clay loams	10,833	4.7
Zimmerman fine sand, 0 to 2 percent slopes	304	.1
Zimmerman fine sand, 0 to 2 percent slopes, moderately wind eroded	48	(1)
Zimmerman fine sand, 2 to 6 percent slopes	718	.3

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Proportionate extent	Soil	Area	Proportionate extent
	Acres	*Percent*		*Acres*	*Percent*
Zimmerman fine sand, 2 to 6 percent slopes, moderately wind eroded	146	0.1	Gravel pits	225	0.1
Zimmerman fine sand, 6 to 12 percent slopes, slightly and moderately eroded	448	.2	Water	7,680	3.3
			Total	232,960	100.0

[1] Less than 0.1 percent.

Alluvial Land

Three miscellaneous land types, called Alluvial land, were mapped on lowlands along the Minnesota River. They were separated on the basis of slope and frequency of overflow.

Alluvial land, 0 to 2 percent slopes (AaA).—This miscellaneous land type consists of well drained to poorly drained soils ranging from sand to clay in texture and from light to dark in color. Because stream channels have cut through them in many places, the soils are flooded nearly every spring and sometimes during other seasons. Management group 6.

Alluvial land, 2 to 6 percent slopes (AaB).—This land type resembles Alluvial land, 0 to 2 percent slopes, but there are some corrugated areas where the surface has been altered by scouring and changes in stream channels. Much of the land is cropped. Management group 6.

Alluvial land, frequent overflow, 0 to 6 percent slopes (Ab).—This is similar to Alluvial land, 0 to 2 percent slopes, but is more frequently flooded. Many areas are so much cut by old stream channels that farming with machinery is impossible. In places the land is corrugated. The elevation from the bottoms of the corrugations to the ridges is 6 to 8 feet, and the distance from ridge to ridge is about 30. In the corrugated areas, the general slope is 2 to 6 percent, but there are some very short slopes that are much steeper. Management group 23.

Beach Materials, Sandy

Beach materials, sandy (Ba) consists of narrow strips of loose sand surrounding some of the present lakes and the beds of former lakes. This land is normally very low in fertility and strictly nonagricultural. It supports a thin stand of grass and a few willows. Management group 26.

Beach Materials and Muck

Beach materials and muck (Bb) occupies about half a section. It has no profile development and is normally poorly drained to very poorly drained. Some of it is nearly level, but because of gradual lowering of lake levels during the time the materials were deposited, some slopes are as much as 6 percent. One very small area has a slope of 8 percent. The natural vegetation is sloughgrass, sedges, reeds, and willows.

This land type can be cropped when it lies sufficiently high above the present water level or where drainage has been installed. Management group 13.

Blue Earth Series

In the Blue Earth series are poorly drained soils that occur in the shallow basins of former lakes. Generally they are on uplands. They are similar to the Glencoe soils but have a surface soil that is more highly calcareous, grayer, fluffier, and generally of finer granular structure. One soil of this series is mapped in the county.

Blue Earth silty clay loam, 0 to 3 percent slopes (Bc).—This soil is mostly on the uplands, but some areas are on the terraces west of Savage where an old lake formed when the river was blocked for a time.

Small shells are on and below the surface. Water may stand on the surface for some time during wet periods. Internal drainage is very poor because of the high water table. The natural vegetation is sloughgrass, sedges, reeds, and willows. Following is a profile description:

Surface soil—
0 to 12 inches, black, mucky, silty clay loam; fine granular structure; very friable; calcareous because it contains many snail shells; shells and lime give the surface soil a gray appearance when dry.
Subsurface layer—
12 to 21 inches, black silty clay loam; fine granular structure; friable; slightly calcareous.
Subsoil—
21 to 28 inches, dark olive-gray clay loam; fine blocky structure; sticky; calcareous.
28 to 40 inches, olive to pale-olive clay loam with prominent mottling; slightly sticky; calcareous.
Underlying material—
40 to 48 inches, dark-brown clay loam with prominent mottling; slightly sticky; calcareous.

This soil varies mainly in the amount of shell fragments and in fluffiness of the surface layer. Drainage ranges from poor to very poor. The texture of the surface soil ranges from silt loam to silty clay loam. Management group 11.

Burnsville, Hayden, Kingsley, and Scandia Series

Soils of the Burnsville, Hayden, Kingsley, and Scandia series occur in the terminal moraine hills in

eastern Scott County. Two kinds of glacial drift, red and gray, are the source of the parent materials. Because of mixing and churning of the two kinds of drift, the soils occur in such complex pattern that it is impractical to separate them on a map of the scale used. Approximately 35 percent of each complex mapped is Kingsley, 30 percent Scandia, 25 percent Hayden, and 10 percent Burnsville.

These are light-colored, hilly, forested soils that formed on clay loam glacial till with which knobs, ridges, or pockets of gravelly and sandy till are mixed. Drainage varies from well drained for Kingsley and Hayden to excessively drained for Burnsville and Scandia. The native vegetation is oak forest, mainly white, bur, and red oaks. The growth is poor, especially on the gravelly areas.

Burnsville, Hayden, Kingsley, and Scandia loams, 0 to 6 percent slopes (BdB).—Low, complex topography is typical of this mapping unit. It has gravelly pockets on tops of the knolls and low ridges. The profiles of three soils of this mapping unit are as follows. A profile of the Hayden member of the mapping unit is described under the Hayden series.

Burnsville profile description:

Surface soil—
0 to 5 inches, light brownish-gray to dark grayish-brown loam to sandy loam; weak fine granular structure; friable; slightly acid.

Subsoil—
5 to 12 inches, light yellowish-brown to dark yellowish-brown loam; weak fine to medium blocky structure; friable; neutral to slightly acid.
12 to 16 inches, light yellowish-brown to yellowish-brown loam; weak fine to medium blocky structure; friable; slightly acid.
16 to 21 inches, light yellowish-brown to yellowish-brown sandy loam; structureless; friable; slightly acid.

Underlying material—
21 inches +, light yellowish-brown sand and gravel with streaks of strong brown; loose; structureless; moderately calcareous.

Glacial boulders occur throughout the profile. The texture of the subsoil varies from sandy loam to loam. The depth to gravel and lime varies.

Kingsley profile description:

Surface soil—
0 to 3 inches, very dark grayish-brown loam; weak fine granular structure; friable; slightly acid.
3 to 9 inches, dark-brown to brown loam; weak fine blocky structure; friable; medium acid.

Subsoil—
9 to 31 inches, strong-brown clay loam; moderate fine to medium blocky structure; firm; strongly acid.

Underlying material—
31 to 37 inches, yellowish-brown clay loam; massive structure; firm; medium acid.
37 inches +, yellowish-brown clay loam; prominently mottled; massive structure; firm; slightly acid.

Scandia profile description:

Surface soil—
0 to 1 inch, very dark brown to brown gravelly sandy loam; structureless; loose; acid.
1 to 8 inches, dark-brown to brown gravelly loamy sand; structureless; loose; acid.

Subsoil—
8 to 30 inches, dark-brown to strong-brown gravel; structureless; loose; acid.

Underlying material—
30 inches +, yellowish-brown gravel; structureless; loose, calcareous at 6 feet.

The profile is normally acid to a depth of about 6 feet. The lower subsoil varies from strong brown to a weak red. In some places the subsoil is loose, structureless, gravelly sandy loam. Management group 3.

Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes (BdC).—The soils of this complex have profiles like those described for the complex on slopes of 0 to 6 percent. The topography is irregular. Gravel pockets are common at the tops of ridges and knolls. Erosion is slight. Management group 8.

Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes, moderately eroded (BdC2).—This complex is similar to Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes, but water erosion has removed about half of the surface soil. Some shallow gullies are present. The supply of organic matter and the productivity are low. Management group 8.

Burnsville, Hayden, Kingsley, and Scandia loams, 12 to 18 percent slopes (BdD).—Except for rolling slopes and profiles that are less deeply developed, this complex is like the complex on slopes of 0 to 6 percent. The slopes are irregular. Gravel and boulders are on the knolls and ridges. Management group 15.

Burnsville, Hayden, Kingsley, and Scandia loams, 12 to 18 percent slopes, moderately eroded (BdD2).—Erosion has removed about half of the surface soil. Otherwise, the profiles of the soils in this complex are like those described for Burnsville, Hayden, Kingsley, and Scandia loams, 0 to 6 percent slopes. The topography is rolling. Management group 15.

Burnsville, Hayden, Kingsley, and Scandia soils, 12 to 18 percent slopes, severely eroded (BeD3).—Except for having lost the surface soil, and in many places part of the subsoil, this complex has profiles like those described for Burnsville, Hayden, Kingsley, and Scandia loams, 0 to 6 percent slopes.

Remnants of the surface soil and upper subsoil are mixed in the plow layer. Gullies are fairly common. The supply of organic matter and the productivity are low. Gravel and stones are at the surface on the knolls and ridges. Management group 22.

Burnsville, Hayden, Kingsley, and Scandia loams, 18 to 25 percent slopes, slightly and moderately eroded (BdE2).—The profiles of the soils in this complex are similar to those described for the complex on slopes of 0 to 6 percent, but they are not so deeply developed. The individual layers are thinner.

Much of this land is wooded or in pasture. Erosion has removed about half of the surface soil from areas that have been used for crops. Boulders, gravel, and fine-textured material are mixed together in pockets on the knolls and ridges. Management group 22.

Burnsville, Hayden, Kingsley, and Scandia soils, 18 to 25 percent slopes, severely eroded (BeE3).—The soils of this complex have profiles similar to those described for the complex on slopes of 0 to 6 percent, but erosion has removed the surface soil and, in many places, part of the subsoil. Gullies are fairly common. Boulders, gravel, and fine-textured material are mixed

together or in pockets on the knolls and ridges. Management group 24.

Burnsville, Hayden, Kingsley, and Scandia loams, 25 to 50 percent slopes (BdF).—The profiles of the soils in this complex are not so thick as those described for the complex on slopes of 0 to 6 percent, and the individual layers are thinner. The greater part of this land is in pasture or woods. The few areas that have been cropped have lost half the surface soil, or more. Boulders, gravel, and fine-textured material occur in pockets on the knolls and ridges. Management group 24.

Clarion Series

The Clarion series is made up of dark-colored, well-drained, undulating to rolling soils. They formed under tall prairie grasses from limy glacial till of clay loam texture. They are comparatively free of stones, but there are a few boulders on the surface and throughout the profile. Associated with the Clarion soils are the LeSueur and Webster soils, which are not so well drained and normally are on milder slopes. The Clarion soils occur in small areas in the southwestern and southern parts of the county.

Clarion silt loam, 2 to 6 percent slopes (CaB).—This soil has the profile typical of the Clarion soils mapped in the county:

Surface soil—
- 0 to 11 inches, black silt loam; moderate fine granular structure; friable; slightly acid.

Subsurface layer—
- 11 to 16 inches, very dark brown silt loam; moderate fine to very fine blocky structure; friable; slightly acid.

Subsoil—
- 16 to 30 inches, dark-brown clay loam; moderate fine blocky structure; slightly sticky; slightly acid.
- 30 to 38 inches, dark yellowish-brown clay loam slightly stained with strong brown; moderate medium blocky structure; friable; neutral.

Underlying material—
- 38 inches +, dark yellowish-brown clay loam with distinct mottles; massive structure; friable.

Calcareous material is reached at a depth of 42 inches, or at less depth on the stronger slopes. The layers vary in thickness. Management group 2.

Clarion silt loam, 2 to 6 percent slopes, moderately eroded (CaB2).—Except for having lost one-fourth to three-fourths of its surface soil through erosion, this soil is similar to Clarion silt loam, 2 to 6 percent slopes. Some of its fertility has been lost with the soil material, and the organic-matter content has been lowered. Management group 2.

Clarion silt loam, 6 to 12 percent slopes (CaC).—The profile of this soil is similar to that described for Clarion silt loam, 2 to 6 percent slopes. The surface soil is 9 to 10 inches thick, instead of 11 inches. Because its slopes are stronger, this soil has more runoff than Clarion silt loam, 2 to 6 percent slopes, and it loses more soil material. Management group 7.

Clarion silt loam, 6 to 12 percent slopes, moderately eroded (CaC2).—Except for having a surface layer 3 to 6 inches thinner and lighter in color, this soil has a profile like that described for Clarion silt loam, 2 to 6 percent slopes. Management group 7.

Clarion soils, 6 to 12 percent slopes, severely eroded (CbC3).—These soils have lost nearly all of their surface soil through erosion. Otherwise, their profile is similar to that described for Clarion silt loam, 2 to 6 percent slopes. In some spots, even the subsoil is eroding. The surface layer, in many places, is a mixture of the original surface soil and the subsoil. Where this mixing has taken place, the surface layer is lighter colored than normal, and lower in organic matter and fertility than the surface layer of any of the other Clarion soils mapped in the county. Management group 15.

Comfrey Series

The Comfrey series consists of moderately fine textured bottom-land soils that range from moderately well drained to somewhat poorly drained. Their surface soil ranges from dark gray to black. These soils are associated with the Rauville soils and the Alluvial lands. Floods are a hazard nearly every spring and occasionally at other seasons. Only one soil of this series is mapped in the county.

Comfrey silty clay loam (Cc).—This soil occurs along Sand Creek and other tributaries of the Minnesota River. The following describes a profile:

Surface soil—
- 0 to 14 inches, black to dark-gray silty clay loam; weak fine granular structure; friable; neutral to slightly alkaline.

Underlying material—
- 14 to 24 inches, dark-gray silty clay loam; moderate fine to medium blocky structure; slightly sticky; neutral.
- 24 inches +, light grayish-brown silty clay loam; massive structure; slightly sticky; mildly alkaline.

This soil is in management group 6.

Copas Series

In the Copas series are well-drained, dark-colored soils derived from shallow deposits of silty or loamy outwash overlying limestone bedrock. Only the lower part of their profile was derived from the limestone. The soils are nearly level to gently sloping. In this county they are on terraces of the Minnesota River from Belle Plaine to Savage. They occur in association with the poorly drained Faxon soils and the excessively drained Stony land. The original vegetation was prairie grasses and a poor growth of oaks and other hardwoods.

Copas silt loam, 0 to 2 percent slopes (CdA).—This soil has good drainage in most places, but in some areas drainage is restricted by bedrock, which is at depths ranging from 12 to 24 inches or more. Following is a profile description:

Surface soil—
- 0 to 9 inches, very dark brown silt loam; moderate very fine to fine granular structure; friable; slightly acid.
- 9 to 13 inches, very dark grayish-brown silt loam; moderate fine blocky structure; friable; slightly acid.

Subsoil—
- 13 to 20 inches, dark yellowish-brown silt loam to clay loam; moderate fine blocky structure; friable; slightly acid.

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20 to 26 inches, dark yellowish-brown clay loam; moderate fine blocky structure; friable; medium acid; some limestone fragments and pebbles in lower part.
Underlying material—
26 inches +, limestone bedrock.

Rock outcrop symbols on the soil map mark areas of this soil that are shallow to bedrock or covered with large boulders. These areas are used for pasture. This soil is in management group 10.

Copas silt loam, 2 to 6 percent slopes (CdB).—Except for stronger slopes and greater risk of erosion, this soil is similar to Copas silt loam, 0 to 2 percent slopes. Management group 10.

Copas silt loam, 2 to 6 percent slopes, moderately eroded (CdB2).—Stronger slopes, moderate erosion, and somewhat shallower depth to bedrock differentiate this soil from Copas silt loam, 0 to 2 percent slopes. The surface soil is 2 to 6 inches thinner than that of the Copas soil on slopes of 0 to 2 percent. Included with this soil are a few acres with slopes of 8 and 9 percent. Management group 10.

Dakota Series

The Dakota soils are on sandy outwash plains and terraces. They are dark-colored, well drained to excessively drained soils that formed under prairie grasses. The parent material is leached, moderately coarse textured sediments overlying predominantly sandy outwash. The underlying outwash material generally is coarser with depth.

The topography ranges from nearly level to rolling. Associated soils are the Estherville, Waukegan, and Hubbard. The Dakota soils differ from the Estherville soils in being underlain chiefly by sand rather than gravel. The Waukegan soils differ from the Dakota in being silty in the upper 2 or 3 feet. Both the Hubbard and Dakota are sandy, but Dakota soils have more fine material in the surface soil and subsoil and hold more moisture.

Dakota loam, 0 to 2 percent slopes (DaA).—This soil is underlain by sand or, occasionally, by fine gravel. The following describes a profile:

Surface soil—
0 to 10 inches, dark-brown loam; weak fine granular structure; friable; slightly acid.
Subsurface layer—
10 to 14 inches, dark-brown to brown loam; weak fine granular structure; friable; medium acid.
Subsoil—
14 to 18 inches, strong-brown loam; weak fine blocky structure; friable; medium acid.
18 to 24 inches, reddish-yellow loam; weak medium blocky structure; friable; medium acid.
Underlying material—
24 to 30 inches, reddish-yellow sands; structureless; loose; slightly acid.
30 inches +, pink sands; structureless; loose; slightly acid.

In some places, the underlying material is 36 to 42 inches from the surface. The deeper underlying sand and gravel are calcareous in some places. Management group 4.

Dakota loam, 2 to 6 percent slopes (DaB).—The profile of this soil is similar to that for Dakota loam, 0 to 2 percent slopes, except in the degree of slope. Management group 4.

Dakota loam, 2 to 6 percent slopes, moderately eroded (DaB2).—Except for having lost 3 to 6 inches of surface soil and having greater slope, this soil is similar to Dakota loam, 0 to 2 percent slopes. As a result of the loss of topsoil, this soil also has a lower organic-matter content. Management group 4.

Dakota loam, 6 to 12 percent slopes, moderately eroded (DaC2).—From 4 to 6 inches of surface soil has been lost from this soil, but in other respects the profile resembles that of Dakota loam, 0 to 2 percent slopes. The surface soil is lighter colored than that of Dakota loam, 0 to 2 percent slopes, and contains less organic matter. Because of stronger slopes, this soil must be farmed more carefully. Management group 9.

Dakota sandy loam, 0 to 2 percent slopes (DbA).—This nearly level soil is underlain by predominantly loose sand at depths of 18 inches or more. It has somewhat better water-holding capacity than Hubbard loamy fine sand, 0 to 2 percent slopes. Wind erosion is slightly active on nearly all areas of this soil. Late crops may be affected by drought if the rainfall is not evenly distributed during the growing season. The following is a profile description:

Surface soil—
0 to 12 inches, very dark grayish-brown sandy loam; moderate medium blocky structure; friable; medium acid.
Subsurface layer—
12 to 16 inches, dark-brown sandy loam; weak medium to coarse blocky structure; friable; strongly acid.
Subsoil—
16 to 21 inches, dark yellowish-brown sandy loam; moderate fine to medium blocky structure; friable; medium acid.
Underlying material—
21 to 38 inches, yellowish-brown sand; structureless; loose; slightly acid.
38 inches +, brownish-yellow sand; structureless; loose; slightly acid.

This soil is in management group 14.

Dakota sandy loam, 2 to 6 percent slopes (DbB).—Low, dunelike topography differentiates this soil from Dakota sandy loam, 0 to 2 percent slopes. Slight wind erosion affects most areas of this soil. Drought is a hazard to late crops of grain and corn. Management group 14.

Dakota sandy loam, 2 to 6 percent slopes, moderately eroded (DbB2).—This soil is similar to Dakota sandy loam, 0 to 2 percent slopes, in profile characteristics, but it is more sloping. Also, erosion has removed 3 or 4 inches of surface soil. Both wind and water are active in removing soil material. Management group 14.

Dakota sandy loam, 6 to 12 percent slopes, moderately eroded (DbC2).—Only a small acreage of this soil occurs in Scott County. It is normally on slopes between different terrace levels. Wind and water erosion have reduced the depth of fine material over sand and thereby have lowered the moisture-holding capacity and fertility. Otherwise, this soil is similar to Dakota sandy loam, 0 to 2 percent slopes, in profile characteristics. Management group 17.

Dorchester Series

These bottom-land soils occur along the Minnesota River. They are forming from light-colored, medium- to fine-textured recent deposits and have no profile development. Dorchester soils occur in association with the poorly drained Oshawa soils and the Alluvial lands. Dorchester soils range from well drained to somewhat poorly drained. Corn is the principal crop. Spring floods usually delay planting. Occasionally, perhaps once in 5 years, a late flood damages crops.

Dorchester silty clay loam (Dd).—This soil is moderately well drained to somewhat poorly drained. Shell fragments are on the surface in many places. The following is a profile description:

Surface soil—
0 to 30 inches, grayish-brown to light brownish-gray silty clay loam; friable; mildly alkaline.
Underlying material—
30 inches +, dark grayish-brown stratified silty clay loam and very fine sandy loam.

This soil is in management group 6.

Dorchester loam and silt loam (Dc).—These soils have a profile similar to that described for Dorchester silty clay loam, but stratified silt and fine sand are nearer the surface. Fewer shell fragments are on the surface. This soil is normally well drained. Management group 6.

Duelm Series

The Duelm soils are moderately dark colored soils of the terraces derived from wind- and water-assorted fine sands. They are intermediate in drainage between the Isanti and the Zimmerman and Hubbard soils, with which they are associated. The acreage of Duelm soils in this county is mostly in two areas. One area is west of Jordan, and the other is about midway between Shakopee and Savage. The soils occupy flats that are above the Isanti depressions and slightly below the low dunelike areas of Zimmerman and Hubbard soils. The natural vegetation is mixed hardwoods, with a preponderance of oak and aspen. The water table is fairly high, but artificial drainage by wide-bottom ditches is not necessary for most general crops.

Duelm fine sandy loam, 0 to 3 percent slopes (De).—The surface soil is normally fine sandy loam, but in places the surface soil and subsoil are of loam texture. The subsoil is light colored and prominently mottled in many places. Included along with this soil is a very small acreage on slopes of more than 3 percent. The following is a profile description:

Surface soil—
0 to 8 inches, black loam or fine sandy loam; weak medium to coarse blocky structure; friable; neutral.
Subsurface layer—
8 to 16 inches, black to very dark-gray sandy loam; weak fine to medium blocky structure; friable; neutral.
Subsoil—
16 to 21 inches, dark grayish-brown fine sand; distinctly mottled; structureless; loose; neutral.
21 to 33 inches, dark grayish-brown to grayish-brown fine sand; distinctly mottled; structureless; loose; neutral.
Underlying material—
33 inches +, pale-yellow fine sand; structureless; loose; neutral.

This soil is in management group 12.

Dundas Series

Dundas soils occur only on the extreme western edge of the county and on small flats in the eastern third. They are associated with both Lester and Hayden soils under conditions of somewhat poor to poor drainage. The natural vegetation consists of mixed hardwoods—mainly elm, ash, basswood, and maple.

Dundas silt loam, 0 to 2 percent slopes (Df).—This soil is moderately dark colored and is underlain by calcareous clay loam similar to that underlying the Lester and Hayden soils. The following is a profile description:

Surface soil—
0 to 9 inches, very dark gray silt loam; weak fine granular structure; very friable; slightly acid.
Subsurface layer—
9 to 13 inches, grayish-brown silt loam; moderate fine to very fine blocky structure; very friable; slightly acid.
Subsoil—
13 to 23 inches, very dark gray silty clay loam; moderate fine to very fine blocky structure; very firm; medium acid.
23 to 44 inches, grayish-brown silty clay loam; distinctly mottled; moderate fine to very fine blocky structure; firm; slightly acid.
Underlying material—
44 inches +, light olive-brown clay loam; distinct mottling; massive structure; friable; neutral; mildly alkaline at 47 inches.

Drainage will benefit this soil, but because of the less permeable subsoil, tile may be effective only if surface inlets are installed. Management group 5.

Dune Land

Dune land (Dg) is scattered throughout the Zimmerman soil area in Eagle Creek Township and throughout the Hubbard soils in section 13, St. Lawrence Township. The areas are small. This land consists of loose sandy material blown about by the wind. Severe blowouts and fresh dune deposits have made these areas of little or no use. Soil profile characteristics have been destroyed. Control of wind erosion is difficult. This very droughty land is in management group 26.

Estherville Series

The Estherville soils are dark-colored soils that developed under prairie grasses on gravelly and sandy outwash plains and terraces. They tend to be droughty because they are underlain by gravel at depths of 6 to 24 inches. Associated with the Estherville soils are the Hubbard soils, which are sandy throughout, and the Kasota soils, which are deeper to gravel. The topography ranges from nearly level to rolling.

Estherville gravelly sandy loam, 0 to 6 percent slopes (EbB).—This nearly level to gently sloping soil is on terraces along the Minnesota River. It is extremely droughty, for the depth to gravel is normally not

more than 10 or 12 inches. In many places the gravel is exposed at the surface. Little can be done to reduce the droughtiness of this soil or to increase its moisture-holding capacity. It is a source of road gravel, and many pits have been opened for this purpose. The following is a profile description:

Surface soil—
0 to 6 inches, very dark brown gravelly sandy loam; moderate fine to medium blocky structure; moderately friable; medium acid.
Subsoil—
6 to 10 inches, dark-brown gravelly sandy loam; structureless; slightly compacted; strongly acid.
10 to 20 inches, dark yellowish-brown gravel; structureless; slightly acid.
Underlying material—
20 to 29 inches, brown gravel; structureless; slightly acid.
29 inches +, brown stratified sand and gravel; structureless; mildly calcareous.

This soil is in management group 20.

Estherville gravelly sandy loam, 0 to 6 percent slopes, moderately eroded (EbB2).—The profile of this soil is similar to that for Estherville gravelly sandy loam, 0 to 6 percent slopes. However, part of the surface soil has been removed by wind, sheet, and gully erosion. Management group 20.

Estherville gravelly sandy loam, 6 to 12 percent slopes (EbC).—This soil is similar to Estherville gravelly sandy loam, 0 to 6 percent slopes, in everything except its greater degree of slope. The slope, in turn, causes increased droughtiness. Management group 25.

Estherville gravelly sandy loam, 6 to 12 percent slopes, moderately eroded (EbC2).—This soil has a profile similar to that of Estherville gravelly sandy loam, 0 to 6 percent slopes. Erosion by wind and water has removed 3 to 4 inches of the surface soil. Management group 25.

Estherville loam and sandy loam, 0 to 2 percent slopes (EaA).—These nearly level soils occur in rather large flats on terraces along the Minnesota River (fig. 3). They are more productive than Estherville gravelly sandy loam on corresponding slopes. Their moisture-holding capacity is greater because they have a finer textured surface soil and subsoil. The depth to gravel ranges from 18 to 24 inches. Many gravel pits have been opened in this soil. The following describes a profile:

Surface soil—
0 to 6 inches, very dark brown loam to sandy loam; moderate fine granular or blocky structure; friable; neutral.
Subsurface layer—
6 to 12 inches, dark-brown loam; moderate fine blocky structure; friable; slightly acid.
Subsoil—
12 to 19 inches, dark-brown to dark yellowish-brown loam or clay loam; weak to moderate very fine to fine blocky structure; friable; slightly acid.
19 to 22 inches, dark-brown to dark yellowish-brown sandy loam; weak to moderate medium to coarse blocky structure; friable; medium acid.
Underlying material—
22 to 29 inches, dark-brown loamy sand to sand; structureless; loose; slightly acid.
29 inches +, brown sand and gravel; structureless; stratified; mildly calcareous.

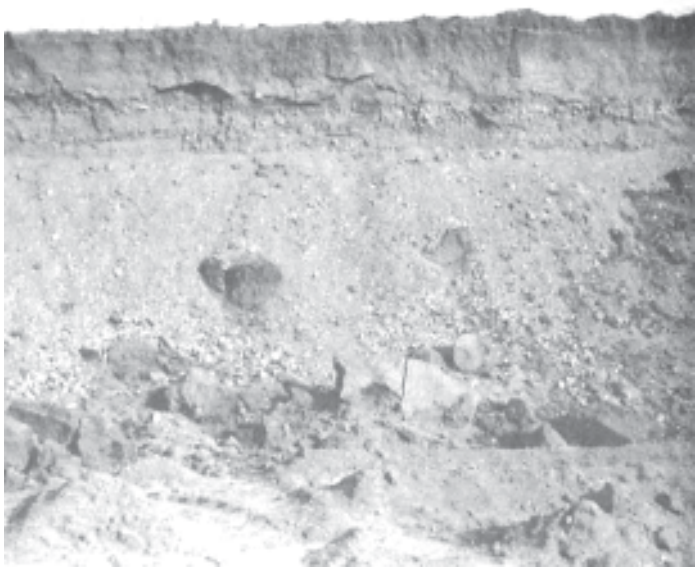

Figure 3.—**Cut in Estherville loam and sandy loam soils showing stratification by water.**

This soil is in management group 14.

Estherville loam and sandy loam, 2 to 6 percent slopes (EaB).—These soils are similar to Estherville loam and sandy loam, 0 to 2 percent slopes, except that they are more sloping. Management group 14.

Estherville loam and sandy loam, 2 to 6 percent slopes, moderately eroded (EaB2).—These soils are similar to Estherville loam and sandy loam, 0 to 2 percent slopes, except that they are more sloping and their surface soil is 3 to 4 inches thinner because of erosion. Management group 14.

Estherville loam and sandy loam, 6 to 12 percent slopes (EaC).—These soils have a profile similar to that of Estherville loam and sandy loam, 0 to 2 percent slopes, but slopes are stronger. Management group 17.

Estherville loam and sandy loam, 6 to 12 percent slopes, moderately eroded (EaC2).—These soils have a profile similar to that of Estherville loam and sandy loam, 0 to 2 percent slopes, but erosion has removed 3 to 4 inches of the surface soil. Management group 17.

Faxon Series

Faxon soils have developed under poor to very poor drainage from medium- to fine-textured alluvial deposits that overlie limestone and sandstone bedrock. The Faxon soils are associated with the well-drained Copas. Like the Copas, they are shallow to bedrock. Large glacial boulders frequently occur on the surface. The native vegetation is normally grass, sedges, willows, and, in a few places, hardwood timber. Only one soil of the Faxon series is mapped in Scott County.

Faxon silty clay loam, 0 to 6 percent slopes (Fa).—This soil is ordinarily hummocky and strewn with boulders. It is on low terraces along the Minnesota River, mainly between Belle Plaine and Jordan and between Shakopee and Savage. The water table is

generally high, or from near the surface to a depth of 2 feet. The depth to limestone or sandstone bedrock varies from 10 to 30 inches or more. Included is a small area on a seepy sidehill that has stronger slopes. The following describes a profile of this soil:

Surface soil—
0 to 15 inches, black mucky silty clay loam; moderate fine to medium granular structure; slightly sticky; calcareous.
Subsoil—
15 to 20 inches, very dark grayish-brown silty clay loam; weak fine blocky structure; sticky; neutral.
20 to 25 inches, light olive-brown clay loam; prominently mottled; weak fine blocky structure; slightly sticky; mildly calcareous.
Underlying material—
25 to 29 inches, olive-yellow clay loam with prominent mottling; weak fine blocky structure; slightly sticky; calcareous; contains lime fragments.
29 inches +, soft limestone bedrock.

This soil is not suited to cultivation, and drainage normally is not feasible. Management group 21.

Glencoe Series

The Glencoe soils are very poorly drained upland soils derived from limy clay loam glacial till. They are widely distributed in depressions and low drainageways. In many places deposits washed from surrounding higher land cover these soils to varying depths. The dark-colored surface soil is high in organic matter and ranges from 14 to 20 inches in depth. In many places a thin layer of partly disintegrated peat covers the surface and imparts a fluffy feel when it is mixed with the dry surface soil by cultivation. The natural vegetation is grass, sedges, reeds, and a few clumps of willows. Soils associated with the Glencoe are the poorly drained Webster, the moderately well drained LeSueur, and the well-drained Clarion, Lester, and Hayden. One soil of the Glencoe series is mapped in the county.

Glencoe silty clay loam (Ga).—The following describes a profile of the soil:

Surface soil—
0 to 15 inches, black silty clay loam; moderate very fine to fine granular structure; friable to firm; neutral.
Subsurface layer—
15 to 19 inches, black silty clay; moderate to strong fine to medium blocky structure; very firm; slightly acid.
Subsoil—
19 to 27 inches, olive-gray silty clay; moderate to strong fine to medium blocky structure; very firm; slightly acid.
27 to 33 inches, olive-gray clay loam spotted with gray; moderate to strong fine blocky structure; very firm; mildly calcareous.
Underlying material—
33 to 46 inches, olive-gray clay loam that is prominently mottled; massive; firm to friable; moderately calcareous.

In some places the subsurface layer and the subsoil may be a silty clay loam. This soil is in management group 11.

Hayden Series

The light-colored, well-drained Hayden soils formed under a mixed hardwood forest from limy clay loam glacial till. They occupy about one-third of the uplands of Scott County and are principally in the six eastern townships. They are undulating to hilly, and the slopes are mostly irregular. Associated with the Hayden soils are the very poorly drained Glencoe, the gravelly and somewhat excessively drained Burnsville, and the well-drained and darker colored Lester. In general, the Hayden soils contain less organic matter than either the Clarion or the Lester soils and are, therefore, slightly less productive. They also tend to be slightly more acid than the Clarion or Lester.

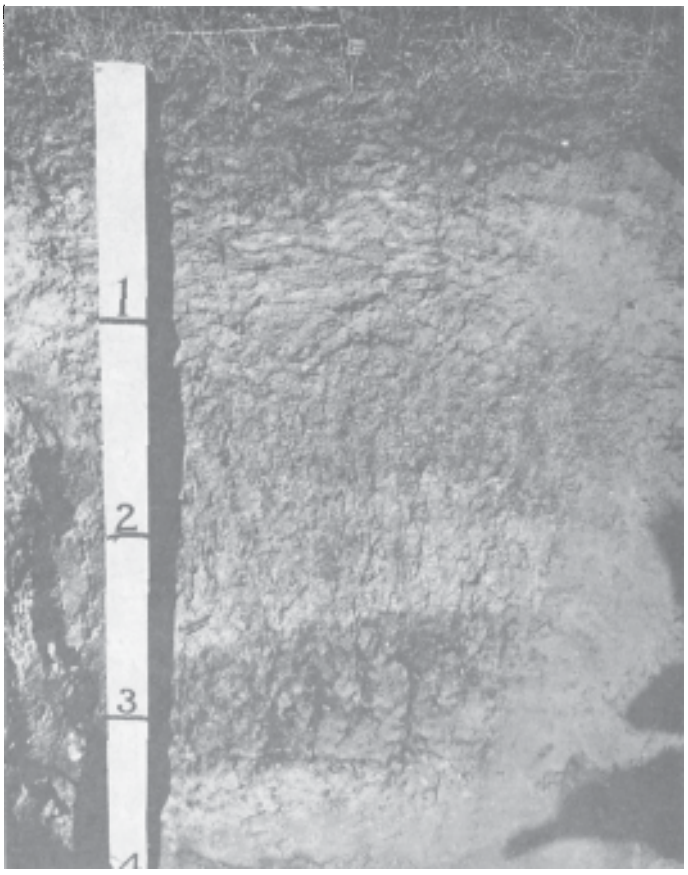

Figure 4.—**Profile of Hayden loam.**

Hayden loam, 6 to 12 percent slopes (HaC).—This soil occupies a considerable acreage in the county (fig. 4). Many of the slopes are complex. Surface runoff is medium to rapid, but the soil has a good moisture-holding capacity. Following is a profile description:

Surface soil—
0 to 2 inches, very dark brown loam; weak very fine to fine granular structure; very friable; slightly acid.
2 to 9 inches, dark-gray to gray loam; moderate thin platy structure; very friable; medium acid.
Subsoil—
9 to 11 inches, dark grayish-brown clay loam; strong very fine to fine blocky structure; firm; strongly acid.
11 to 17 inches, dark grayish-brown silty clay loam; strong fine blocky structure; very firm; strongly acid.
17 to 22 inches, brown to dark-brown clay loam; strong fine to medium blocky structure; firm; strongly acid.
22 to 26 inches, dark yellowish-brown clay loam; moderate fine to medium blocky structure; friable; medium acid.

Underlying material—
26 to 45 inches, yellowish-brown loam to clay loam; distinctly mottled; massive structure; friable; medium acid.
45 inches +, light olive-brown loam to clay loam; distinctly mottled; massive structure; very friable; moderately calcareous.

This soil is in management group 8.

Hayden loam, 0 to 6 percent slopes (HaB).—Much of this soil occurs on low, moundlike, complex slopes. Some small areas, however, are nearly level. Because the slopes are short, little erosion takes place.

The profile of this soil resembles that of Hayden loam, 6 to 12 percent slopes, but it is more silty throughout. In places it is somewhat better developed and each layer is somewhat thicker. Management group 3.

Hayden loam, 2 to 6 percent slopes, moderately eroded (HaB2).—Except for having lost 3 to 6 inches of surface soil through erosion, this soil is similar to Hayden loam, 6 to 12 percent slopes. In topography, it resembles Hayden loam, 0 to 6 percent slopes. Management group 3.

Hayden loam, 6 to 12 percent slopes, moderately eroded (HaC2).—This soil is similar to Hayden loam, 6 to 12 percent slopes, but has lost from one-fourth to nearly three-fourths of the surface soil. The remaining surface soil is thin and is generally mixed with subsoil. Where organic matter is low, the soil tends to crust. Crusting makes plowing more difficult and allows rain to run off more rapidly. Management group 8.

Hayden loam, 12 to 18 percent slopes (HaD).—Stronger relief is the chief difference between this soil and Hayden loam, 6 to 12 percent slopes. It occupies large acreages within the general Hayden area. Practically all of this soil is in pasture or woods. Management group 15.

Hayden loam, 12 to 18 percent slopes, moderately eroded (HaD2).—Erosion has removed from 3 to 6 inches of the surface soil. The rest of the surface soil has been mixed with subsoil in plowing. In other respects, this soil is similar to Hayden loam, 6 to 12 percent slopes. It occupies considerable acreage within Scott County. Management group 15.

Hayden loam, 18 to 25 percent slopes, slightly and moderately eroded (HaE2).—This soil is hilly. In pastured and wooded areas where erosion has been slight, the profile is similar to that of Hayden loam, 6 to 12 percent slopes, although the individual layers are thinner. It is also similar in areas that have been cropped but has lost from 3 to 6 inches of the surface soil. Management group 22.

Hayden loam, 25 to 35 percent slopes, slightly and moderately eroded (HaF2).—Most of this soil is in pasture or woods, and erosion is slight. In some areas that have been cropped, erosion has removed 4 to 6 inches of the surface soil. The profile resembles that of Hayden loam, 6 to 12 percent slopes, but it is less deeply developed and individual layers are thinner. Management group 24.

Hayden soils, 6 to 12 percent slopes, severely eroded (HcC3).—These soils are a product of the erosion of Hayden loam, 6 to 12 percent slopes. Surface runoff is considerable because of the slope and meager supply of organic matter. Also, these soils tend to bake or form a crust. The subsoil and underlying material correspond to those of Hayden loam, 6 to 12 percent slopes. Management group 15.

Hayden soils, 12 to 18 percent slopes, severely eroded (HcD3).—These soils are a product of the erosion of Hayden loam, 12 to 18 percent slopes. The loss of the surface soil, and in many places much of the subsoil, has reduced productivity to a low level. The subsoil is exposed at the surface. The present surface layer has a higher clay content and a lower organic-matter content than the original surface soil and is therefore more difficult to work. Crusting of the surface increases erosion and runoff. Frequently, in periods of normal rainfall, moisture may be depleted 12 to 18 inches below the surface. The lower subsoil and the underlying material are similar to those of Hayden loam, 6 to 12 percent slopes. Management group 22.

Hayden soils, 18 to 25 percent slopes, severely eroded (HcE3).—These soils are hilly instead of rolling; otherwise, they are similar to Hayden soils, 12 to 18 percent slopes, severely eroded. The lower subsoil and the underlying material are similar to those of Hayden loam, 6 to 12 percent slopes. Management group 24.

Hayden sandy loam, 12 to 18 percent slopes (HbD).—This soil is on complex morainic topography. Surface drainage is somewhat excessive. The till under this soil is coarser than that under Hayden loam. In many places the till contains pockets of sand and gravel that comprise as much as 10 percent of the areas mapped. This sandy loam is much more subject to erosion than the loam when cultivated. Much of this sandy loam is still in forest or pasture. The forest consists of white oak, red oak, aspen, elm, and ironwood. The following is a profile description:

Surface soil—
1 to 0 inch, leaf mold.
0 to 2 inches, dark-brown sandy loam; weak to moderate fine granular structure; friable; slightly acid.
2 to 5 inches, grayish-brown to dark grayish-brown sandy loam; weak to moderate thin platy structure; friable; slightly acid.
5 to 8 inches, very dark grayish-brown sandy loam; weak to moderate fine blocky structure; friable; medium acid.
Subsoil—
8 to 17 inches, dark-brown loam to clay loam; weak to moderate fine to medium blocky structure; firm; medium acid.
17 to 22 inches, dark yellowish-brown sandy loam; weak fine blocky structure; loose; medium acid.
22 to 28 inches, dark yellowish-brown mixed sandy loam and clay loam; weak fine to medium blocky structure; friable; medium acid.
Underlying material—
28 to 32 inches, dark yellowish-brown gravel; structureless; somewhat cemented; slightly acid. (This layer is absent in many places.)
32 inches +, pale-brown sand, light olive-brown gravel, and light olive-brown clay loam; distinctly mottled; structureless or massive; mixed material is loose to friable and moderately calcareous.

A few boulders are on the surface and throughout the profile. Management group 15.

Hayden sandy loam, 0 to 6 percent slopes (HbB).—Only a very small acreage of this soil is in Scott County. The profile is similar to that described for

Hayden sandy loam, 12 to 18 percent slopes. Management group 3.

Hayden sandy loam, 0 to 6 percent slopes, moderately eroded (HbB2).—This soil, very limited in extent, has a profile similar to that of Hayden sandy loam, 12 to 18 percent slopes, but from 2 to 5 inches of the surface soil has been lost. Management group 3.

Hayden sandy loam, 6 to 12 percent slopes (HbC).—This soil is similar to Hayden sandy loam, 12 to 18 percent slopes, except that it is less sloping. Management group 8.

Hayden sandy loam, 6 to 12 percent slopes, moderately eroded (HbC2).—This soil is similar to Hayden sandy loam, 12 to 18 percent slopes, except that it is less steep, and 2 to 5 inches of the surface soil has eroded away. Management group 8.

Hayden sandy loam, 12 to 18 percent slopes, moderately eroded (HbD2).—The profile of this soil is similar to that of Hayden sandy loam, 12 to 18 percent slopes, but cultivation has mixed the upper three layers and erosion has removed from 2 to 5 inches of surface soil. Management group 15.

Hayden sandy loam, 18 to 25 percent slopes, slightly and moderately eroded (HbE2).—This soil is similar to Hayden sandy loam, 12 to 18 percent slopes, but is more hilly. Part of it is still in pasture or forest. The rest has been cropped and has lost from 2 to 6 inches of the surface soil. Management group 22.

Hayden sandy loam, 25 to 35 percent slopes, slightly and moderately eroded (HbF2).—Most of this soil is in pasture or woods, and erosion is slight. Some areas, however, have been cropped, and erosion has removed 4 to 6 inches of the surface soil. The profile resembles that of Hayden sandy loam, 12 to 18 percent slopes, but is less deeply developed because of the steep slopes. Management group 24.

Hayden sandy clay loam, 12 to 18 percent slopes, severely eroded (HbD3).—The subsoil and underlying material of this soil resemble those of Hayden sandy loam, 12 to 18 percent slopes. Most of the surface soil has been lost through erosion; that remaining has been mixed with the subsoil in the plow layer. Management group 22.

Hayden sandy clay loam, 18 to 25 percent slopes, severely eroded (HbE3).—The subsoil and underlying material of this hilly soil resemble those of Hayden sandy loam, 12 to 18 percent slopes. Most of the surface soil has been lost through erosion; that remaining is mixed with the subsoil in the plow layer. Management group 24.

Hubbard Series

Hubbard soils are moderately dark colored soils that developed on sandy terraces along streams. They are the most extensive of the terrace soils in Scott County. Wind erosion is active wherever these soils are not protected by vegetation. The native cover is sparse grass. The topography ranges from nearly level to undulating. In some areas the dunelike relief suggests that the wind shifted the soil material considerably soon after it was deposited by glacial melt water. Hubbard soils occur in association with Estherville soils, which are shallow to gravel; Waukegan soils, which are silty to a depth of about 3 feet; and Dakota soils, which are sandy but have good moisture-holding capacity.

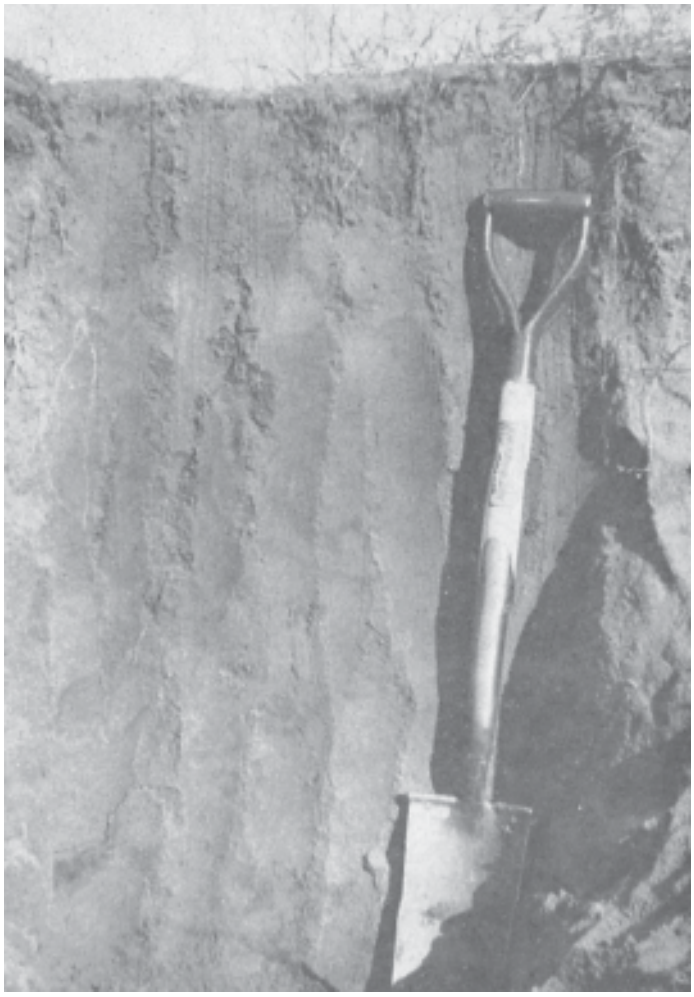

Figure 5.—**Profile of Hubbard fine sand, 0 to 2 percent slopes.**

Hubbard fine sand, 0 to 2 percent slopes (HdA).—Little, if any, soil development other than that shown by color is evident in this soil (fig. 5). Slight wind erosion is present in most areas. The surface soil therefore varies slightly in depth, depending on whether the wind is removing or depositing material. The following is a profile description:

Surface soil—
0 to 4 inches, very dark gray fine sand to loamy fine sand; structureless to weak very fine granular structure; loose; slightly acid.
4 to 12 inches, very dark grayish-brown fine sand; structureless; loose; slightly acid.
Subsoil—
12 to 38 inches, dark-brown fine sand; structureless; loose; slightly acid.
Underlying material—
38 inches +, yellowish-brown fine sand; structureless; loose; medium acid.

This soil is in management group 26.

Hubbard fine sand, 2 to 6 percent slopes (HdB).—In profile characteristics this soil is similar to Hubbard fine sand, 0 to 2 percent slopes. It differs in that it has a low, dunelike topography instead of being nearly level. Slight wind erosion is active in areas not protected by permanent vegetation. Management group 26.

Hubbard fine sand, 2 to 6 percent slopes, moderately wind eroded (HdB2).—This soil also has a low, dunelike topography. Wind erosion is moderately active. In addition, some of the sloping cultivated areas are affected by water erosion. The profile below the eroded surface layer is similar to that of Hubbard fine sand, 0 to 2 percent slopes. Management group 26.

Hubbard fine sand, 6 to 12 percent slopes (HdC).—Profile characteristics of this soil are similar to those of Hubbard fine sand, 0 to 2 percent slopes. The topography is rolling and dunelike. Management group 26.

Hubbard fine sand, 6 to 12 percent slopes, moderately wind eroded (HdC2).—This soil is similar to Hubbard fine sand, 0 to 2 percent slopes, except that it is eroded and more sloping. Wind and water erosion have removed 3 to 6 inches of the surface soil. Management group 26.

Hubbard loamy fine sand, 2 to 6 percent slopes (HeB).—Wind erosion is slightly active on large areas of this soil. The following is a profile description:

Surface soil—
0 to 7 inches, very dark brown loamy fine sand; weak very fine to fine granular structure to structureless; loose; neutral.
7 to 20 inches, dark-brown fine sand; structureless; loose; medium acid.
Subsoil—
20 to 38 inches, dark-brown fine sand; structureless; loose; strongly acid.
Underlying material—
38 to 48 inches, dark-brown fine sand; structureless; loose; medium acid.
48 to 54 inches +, dark-brown fine sandy loam; massive structure; very compact; medium acid.

The loamy sand surface layer varies from 2 to 10 inches in depth. Bands of finer textured material are mostly located just below a depth of 36 inches. These bands are 6 inches to 2 feet thick, and their texture ranges from light sandy loam to sandy clay loam. Downward movement of water is restricted, and the sand above the bands is moist many days after Hubbard fine sands are completely dry. Management group 18.

Hubbard loamy fine sand, 0 to 2 percent slopes (HeA).—In most places the soil consists of loamy sand to fine sand to a depth of about 36 inches.

The profile of this soil is similar to that of Hubbard loamy fine sand, 2 to 6 percent slopes. Included with this soil are a few areas that have a loamy sand surface soil, then sandy loam to depths of 1 to 1½ feet, and finally a layer of sand.

Slight wind erosion is active in most areas of this soil. Management group 18.

Hubbard loamy fine sand, 2 to 6 percent slopes, moderately wind eroded (HeB2).—This soil is similar to Hubbard loamy fine sand, 2 to 6 percent slopes, in having dark-colored loamy sand overlying finer textured layers at varying depths. Ordinarily, the finer textured bands are at a depth of about 36 inches, but the depth varies from 8 to 48 inches. Wind erosion has been active in most areas. On some slopes, water erosion has also been active. The topography is dunelike. Management group 18.

Hubbard loamy fine sand, 6 to 12 percent slopes (HeC).—The profile of this soil is similar to that of Hubbard loamy fine sand, 2 to 6 percent slopes. The topography is rolling and dunelike. Management group 19.

Hubbard loamy fine sand, 6 to 12 percent slopes, moderately eroded (HeC2).—This soil is more sloping than Hubbard loamy fine sand, 2 to 6 percent slopes. Its profile is similar, but erosion by wind or water has removed 3 to 6 inches of the surface layer. Management group 19.

Isanti Series

The Isanti soils are in very poorly drained depressions and flats, chiefly in association with Zimmerman soils. A few areas are in wet depressions within larger areas of Hubbard soils. The Isanti soils were derived from wind- and water-sorted fine sands. They are nearly level, but in a few small areas the slopes are as much as 3 percent. The water table is high much of the year. Most areas of the Isanti soils are covered with reeds and sedges, but there are some clumps of willow, hazel, and dogwood. One soil of this series was mapped in the county.

Isanti fine sandy loam (Ia).—The following describes a profile of this soil:

Surface soil—
0 to 12 inches, black loam or fine sandy loam streaked with dark grayish brown and strong brown; weak fine to medium blocky structure; mucky; sticky; neutral.
Subsoil—
12 to 21 inches, very dark brown mucky sandy loam streaked with dark gray and light olive brown; weak fine to medium blocky structure; slightly sticky; neutral.
21 to 26 inches, very dark gray sandy loam; distinctly mottled; weak fine blocky structure; slightly sticky; slightly acid.
Underlying material—
26 to 31 inches, very dark gray loamy sand mixed with grayish-brown loamy sand; structureless; slightly acid.
31 inches +, dark gray to very dark gray fine sand; structureless; slightly acid.

Some areas are more sandy and not so deep as indicated by this profile. This soil is in management group 12.

Kasota Series

In the Kasota series are dark-colored prairie soils that have a rather firm, tight clay loam or silty clay layer in the subsoil. This layer ranges from 6 to 15 inches in thickness. Below the surface soil and subsoil lie calcareous mixed sand and gravel. The Kasota soils are mostly on nearly level terrace flats, but there are some undulating areas near drainageways. These soils, with the associated Waukegan, are the best agricultural soils on the terraces.

The Kasota soils differ from the Waukegan in being less silty through the subsoil and normally much shallower to calcareous sand or gravel. They are deeper to gravel than the Estherville soils, and they have a plastic, fine-textured layer in their subsoil that does not occur in the Estherville.

Kasota silt loam, 0 to 2 percent slopes (KaA).—Most of this soil is on large terrace flats in the vicinity of Belle Plaine. Smaller areas are on other terraces. The following describes a profile:

Surface soil—
0 to 8 inches, black silt loam; weak fine to coarse blocky structure; friable; neutral.
Subsurface soil—
8 to 14 inches, very dark brown silt loam; weak fine to coarse blocky structure; friable; slightly acid.
Subsoil—
14 to 22 inches, dark-brown to dark yellowish-brown clay loam; weak fine to coarse blocky structure; very firm; compact; medium acid.
22 to 27 inches, dark yellowish-brown sandy loam; moderate medium to coarse blocky structure; friable; medium acid.
Underlying material—
27 to 33 inches, dark yellowish-brown gravelly sandy loam to gravel; structureless; loose; medium acid.
33 inches +, olive-brown gravel; structureless; loose; mildly calcareous.

The fine-textured layer in the subsoil varies from 6 to 15 inches in thickness and from sandy clay loam to clay in texture. Gritty (sandy) material may occur in any or all of the layers.

In most areas these soils are 26 to 35 inches deep to gravel. In about half a section near Belle Plaine, however, they are only 20 inches deep to gravel but have the plastic clay layer in the subsoil. Generally, the clay loam or silty clay carries down to depths of 26 to 29 inches, where sandy material begins. These soils are in management group 4.

Kasota silt loam, 2 to 6 percent slopes (KaB).—There are a few areas of this soil around the heads of drainageways. A small part is eroded. The profile of this soil is similar to that described for Kasota silt loam, 0 to 2 percent slopes. Management group 4.

Lakeville-Burnsville Series

The Lakeville soils are dark-colored soils that developed from sandy and gravelly calcareous till. Small areas occur throughout the uplands. The native vegetation was a sparse growth of tall grasses with a few clumps of oaks. The Burnsville soils are similar to the Lakeville but have a lighter colored surface soil. Their original vegetation was mixed hardwood forest in which oak predominated.

The topography for both soils is complex; ordinarily, morainic hills and ridges. The Lakeville loam has smoother topography than the Burnsville. Associated with the Lakeville-Burnsville soils are the well-drained Lester and Hayden soils on calcareous clay loam till. Drought seriously affects crops on Lakeville-Burnsville soils during periods of low rainfall. Both surface runoff and internal drainage are excessive.

Lakeville-Burnsville gravelly sandy loams, 6 to 12 percent slopes, moderately eroded (LbC2).—The largest areas of these soils are east of the town of Prior Lake. As with all Lakeville-Burnsville soils, individual areas and the total acreages are small. Gravel pits are common, and the gravel occurs near or at the surface. The profile of one of the Lakeville soils of this complex is described in the following. A profile of the Burnsville member of the complex is described under the Burnsville, Hayden, Kingsley, and Scandia series.

Lakeville profile description:

Surface soil—
0 to 10 inches, dark-brown sandy loam streaked with very dark brown; weak fine granular and blocky structure; friable; neutral to slightly acid.
Subsoil—
10 to 18 inches, dark-brown to dark yellowish-brown sandy loam; weak fine blocky structure; very friable; slightly acid.
Underlying material—
18 to 27 inches, yellowish-brown gravel; structureless; slightly acid to neutral.
27 inches +, very pale brown fine gravel and sand splotched with yellowish red; structureless; loose; mildly calcareous.

This complex is in management group 25.

Lakeville-Burnsville gravelly sandy loams, 0 to 6 percent slopes (LbB).—These soils are very shallow to gravel and are very droughty. They are similar to Lakeville-Burnsville gravelly sandy loams, 6 to 12 percent slopes, moderately eroded. The texture of the surface soil varies from a gravelly sandy loam to a sandy loam. Sand or gravel is normally at a depth of 18 inches or less, and there are pits in many places from which road gravel is taken. Management group 20.

Lakeville-Burnsville gravelly sandy loams, 0 to 6 percent slopes, moderately eroded (LbB2).—These soils are similar to Lakeville-Burnsville gravelly sandy loam, 6 to 12 percent slopes, moderately eroded, except that they have more gentle slopes. Management group 20.

Lakeville-Burnsville gravelly sandy loams, 6 to 12 percent slopes (LbC).—These soils are similar to Lakeville-Burnsville gravelly sandy loam, 6 to 12 percent slopes, moderately eroded. However, erosion has not been so active; hence, somewhat more surface soil remains. Management group 25.

Lakeville-Burnsville gravelly sandy loams, 12 to 50 percent slopes (LbD).—These soils are extremely variable in profile characteristics. The surface soil ranges in texture from loam to gravel; the depth to gravel ranges from 0 to 24 inches. The soils are very droughty, and the topography is steep and complex.

There are large gravel pits in these soils. Erosion is severe, and deep gullies form rapidly where the soils are cultivated. Sand and gravel washed from the gullies damage better land below. Management group 25.

Lakeville Series

Lakeville loam, 0 to 2 percent slopes (LaA).—This nearly level upland soil (fig. 6) is similar to Estherville loam and sandy loam, 0 to 2 percent slopes, which is on terraces. The gravel and sands in the underlying material are not so stratified as in the Estherville soils.

Figure 6.—**Profile of Lakeville loam photographed when dry.**

Lakeville loam has a finer textured surface soil and subsoil and is deeper to gravel than the Lakeville-Burnsville gravelly sandy loams. It is also less droughty and holds more water. The following is a profile description:

Surface soil—
0 to 11 inches, black to very dark brown loam; moderate fine to medium blocky structure; friable; slightly acid.
Subsurface layer—
11 to 16 inches, very dark-brown loam; moderate fine to medium blocky structure; friable; slightly acid.
Subsoil—
16 to 25 inches, dark-brown gravelly loam; weak fine blocky structure; friable to loose; somewhat cemented; slightly acid.
Underlying material—
25 inches +, brown gravel spotted with light olive brown; structureless; loose, mildly calcareous.

The depth to gravel ranges from 24 to 36 inches. In places the subsoil is a sandy loam or clay loam, and these finer textures extend slightly deeper than 24 inches. Management group 4.

Lakeville loam, 2 to 6 percent slopes (LaB).—The chief difference between this soil and Lakeville loam, 0 to 2 percent slopes, is in the degree of slope. Management group 4.

Lakeville loam, 2 to 6 percent slopes, moderately eroded (LaB2).—This soil is similar to Lakeville loam, 0 to 2 percent slopes, but is more sloping. Erosion has removed 3 to 6 inches of the surface soil. Management group 4.

Lakeville loam, 6 to 12 percent slopes (LaC).—The profile of this soil is similar to that of Lakeville loam, 0 to 2 percent slopes. This soil has irregular, short, complex slopes. Management group 9.

Lakeville loam, 6 to 12 percent slopes, moderately eroded (LaC2).—This soil has a profile similar to that of Lakeville loam, 0 to 2 percent slopes, but erosion has removed one-fourth to three-fourths of the surface soil. Management group 9.

Lakeville loam, 12 to 18 percent slopes (LaD).—Rolling topography is the chief difference between this soil and Lakeville loam, 0 to 2 percent slopes. Management group 16.

Lakeville loam, 12 to 18 percent slopes, moderately eroded (LaD2).—The profile of this soil is similar to that of Lakeville loam, 0 to 2 percent slopes. One-fourth to three-fourths of the surface soil has been eroded away, however, and the relief is rolling. There are a few severely eroded areas where the subsoil is exposed, as well as some areas where irregular gravel deposits overlie silty moderately calcareous till. The till is exposed in places. Management group 16.

Lester Series

The Lester series is made up of moderately dark-colored soils that occupy a large tract in the central part of the county between the dark-colored Clarion and the light-colored Hayden soils. Lester soils (fig. 7) are well drained; they developed on the same calcareous clay loam till as the Clarion and Hayden soils.

The Lester soils originally developed under tall prairie grasses, but hardwood forests gradually encroached on the prairie. Their relief is stronger than that of Clarion soils, but not so hilly as that of the Hayden soils. The topography ranges from undulating to rolling, and most of the slopes are complex.

Associated with the Lester soils are the Hayden and Clarion soils, which are well drained; the LeSueur, which is moderately well drained; the Webster, which is poorly drained; and the Glencoe, which is very poorly drained.

Lester silt loam, 2 to 6 percent slopes (LcB).—The following is a profile description of this soil:

Surface soil—
0 to 9 inches, black to very dark gray silt loam; moderate very fine to fine granular and blocky structure; friable; neutral.
Subsurface layer—
9 to 12 inches, dark-gray silt loam; moderate thin to very thin platy structure; friable; neutral.
Subsoil—
12 to 17 inches, dark-gray silt loam; moderate to strong fine blocky structure; firm; neutral to slightly acid.
17 to 25 inches, very dark grayish-brown clay loam; strong fine blocky structure; firm to very firm; slightly acid.
25 to 38 inches, dark-brown clay loam; strong fine to medium blocky structure; firm to very firm; strongly acid.

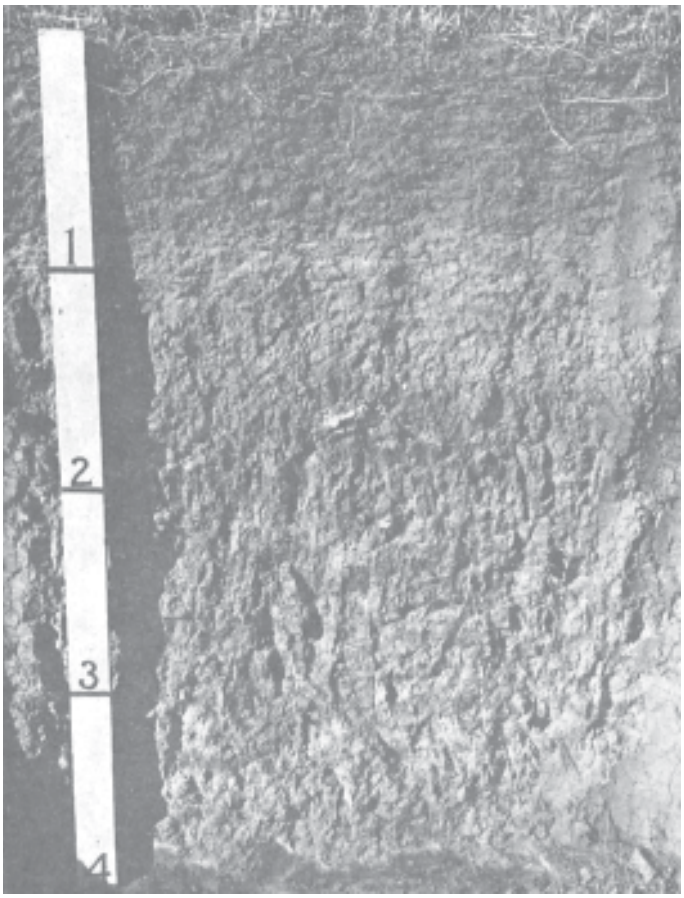

Figure 7.—**Profile of Lester silt loam.**

Underlying material—
38 to 48 inches, olive-brown clay loam that is distinctly mottled; massive; firm to very firm; medium acid.
48 inches +, olive-brown clay loam that is prominently mottled; massive; friable; slightly acid; moderately calcareous at a depth of 53 inches.

The depth to calcareous parent material ranges from 39 to 66 inches. The thickness of the surface soil and the subsurface horizons varies. Management group 2.

Lester silt loam, 2 to 6 percent slopes, moderately eroded (LcB2).—This soil has a profile similar to that of Lester silt loam, 2 to 6 percent slopes, but has lost 2 to 3 inches of surface soil through erosion. Management group 2.

Lester silt loam, 6 to 12 percent slopes (LcC).—This soil has a profile similar to that of Lester silt loam, 2 to 6 percent slopes, but it is more strongly sloping. Management group 7.

Lester silt loam, 6 to 12 percent slopes, moderately eroded (LcC2).—This soil has lost part of its original surface soil, or about 4 to 6 inches. In other respects it is similar to Lester silt loam, 2 to 6 percent slopes. Erosion has removed much organic matter and reduced productivity and moisture-holding capacity. Management group 7.

Lester silt loam, 12 to 18 percent slopes (LcD).—This soil is similar to Lester silt loam, 2 to 6 percent slopes, in profile characteristics but is strongly rolling or hilly. In general, this soil has a somewhat lighter colored and thinner surface soil than Lester silt loam, 2 to 6 percent slopes. In addition, it has less favorable moisture conditions because of steeper slopes that cause more runoff. Management group 15.

Lester silt loam, 12 to 18 percent slopes, moderately eroded (LcD2).—The principal difference between this soil and Lester silt loam, 2 to 6 percent slopes, is that erosion has removed from one-fourth to three-fourths of the original surface soil. The topography is strongly rolling or hilly. Management group 15.

Lester silt loam, 18 to 25 percent slopes, slightly and moderately eroded (LcE2).—This steep soil has about the same profile as Lester silt loam, 2 to 6 percent slopes, but the individual layers are thinner and the entire profile is less deeply developed. Areas still in pasture or woods have eroded very little. Cropped areas, however, have lost 3 to 6 inches of surface soil. Management group 22.

Lester silt loam, 25 to 35 percent slopes, slightly and moderately eroded (LcF2).—This very steep soil has a profile similar to that of Lester silt loam, 2 to 6 percent slopes, but the profile has developed only about half as deep. The surface soil and the subsoil are much thinner, and unweathered parent material is normally present at a depth of about 2 feet. Most of this very steep soil is still in pasture or woods. Areas that have been cultivated a short while have lost from 3 to 6 inches of surface soil. Management group 24.

Lester soils, 12 to 18 percent slopes, severely eroded (LdD3).—These soils are similar to Lester silt loam, 6 to 12 percent slopes, except for high degree of erosion. The following is a profile description:

Surface soil—
0 to 3 inches, very dark grayish-brown, mixed with dark-brown, silty clay loam; weak fine to medium blocky structure; slightly sticky; medium acid.
Subsurface layer—
3 to 9 inches, dark yellowish-brown, mixed with dark-brown, clay loam; weak fine to medium blocky structure; slightly sticky; strongly acid.
Subsoil—
9 to 26 inches, yellowish-brown clay loam; weak fine to medium blocky structure; slightly sticky; medium acid.
Underlying material—
26 inches +, light yellowish-brown clay loam that is distinctly mottled; massive structure; friable; moderately calcareous.

These soils are in management group 22.

Lester soils, 6 to 12 percent slopes, severely eroded (LdC3).—These soils are similar to Lester soils, 12 to 18 percent slopes, but their slopes are not so strong. Remnants of the original silt loam surface and subsurface soil became mixed with the clay loam upper subsoil during tillage. As a result, the present surface layer is a silty clay loam. There are a few small gullies. The amount of organic matter is very low, and the productivity and moisture-holding capacity are thus limited. In addition, the surface crusts and makes tillage difficult and increases runoff. Management group 15.

Lester soils, 18 to 25 percent slopes, severely eroded (LdE3).—These soils have a profile similar to that of

Lester soils, 12 to 18 percent slopes, severely eroded. The topography, however, is steep rather than rolling. Management group 24.

Lester soils, 25 to 35 percent slopes, severely eroded (LdF3).—The profile of these very steep soils is similar to that of Lester soils, 12 to 18 percent slopes, severely eroded. However, the remaining subsoil above the parent material is thinner, as the profile was not as deep to start with. Management group 24.

LeSueur Series

The LeSueur soils occur along with, and in complex with, Lester and Webster soils. They are moderately well drained, dark-colored soils, in contrast to the well drained Lester soils and poorly drained Webster soils. They are slightly more sloping than the Webster soils, which are nearly level.

LeSueur soils have formed from the same calcareous clay loam till as the Lester and Clarion. The native vegetation is a hardwood forest of maple, basswood, elm, and red oak.

LeSueur silt loam (Le).—The largest area of this soil is on an extensive flat 2 miles east of the town of Prior Lake and just north of Cleary Lake. Included with this soil are a few areas with slopes of more than 3 percent. The following is a profile description:

Surface soil—
0 to 4 inches, black silt loam; moderate very fine to fine granular structure; friable; medium acid.
Subsurface layer—
4 to 12 inches, dark-gray to dark grayish-brown silt loam; weak fine blocky structure; friable; medium acid.
Subsoil—
12 to 17 inches, very dark grayish-brown clay loam; moderate fine blocky structure; slightly sticky; strongly acid.
17 to 28 inches, dark grayish-brown clay loam that shows faint mottles; moderate fine blocky structure; slightly sticky; strongly acid.
Underlying material—
28 to 35 inches, yellowish-brown clay loam; moderate medium blocky structure ranging to massive; slightly sticky; strongly acid.
35 inches +, light olive-brown clay loam that is prominently mottled; massive; slightly acid to mildly calcareous; friable.

This soil is in management group 1.

LeSueur-Lester silt loams (Lf).—In this complex are two soils that developed in such a mixed pattern that they could not be shown separately on the map. The soils are on nearly level till plain where the low microrelief creates drainage differences. The complex is approximately 65 percent LeSueur soil, and 35 percent Lester soil.

For a description of a profile of the Lester soil, see Lester silt loam, 2 to 6 percent slopes. The following is a profile description of the LeSueur soil.

Surface soil—
0 to 9 inches, black silt loam to silty clay loam; moderate very fine to fine granular or blocky structure; friable; neutral.
Subsurface layer—
9 to 13 inches, very dark gray silty clay loam; moderate very fine to fine granular or blocky structure; friable; slightly acid.
Subsoil—
13 to 22 inches, very dark gray silty clay loam; strong fine to medium blocky structure; very firm; very strongly acid.
22 to 40 inches, very dark grayish-brown silty clay with distinct mottles; strong medium blocky structure; very firm; very strongly acid.
Underlying material—
40 to 50 inches, light olive-brown clay loam with prominent mottles; massive; firm to friable; medium acid.
50 inches +, light olive-brown clay loam with prominent mottles; massive; friable; moderately calcareous.

The surface soil ranges from 9 to 16 inches in thickness. The subsurface layer is absent in some places. Where it is absent, the deep surface soil extends to the subsoil. The depth to calcareous material ranges from about 32 inches to more than 50 inches. Management group 1.

Marsh

Marsh (Ma) occupies shallow lakes and ponds that may be dry during years with less than normal precipitation. Most areas, however, remain wet all year. Cattails, rushes, sedges, willows, and other water-tolerant plants grow luxuriantly and provide sanctuaries for wildfowl. Muskrats and mink are caught in the larger marshes. Management group 27.

Oshawa Series

The Oshawa series consists of very poorly drained soils on bottom lands along streams. They are associated with the Dorchester soils, although they normally lie farther away from the stream channel. The water table is always high in the Oshawa soils, and water stands on them for long periods following floods. The natural vegetation is sedges, rushes, tall grasses, and some willows. One soil of this series is mapped in the county.

Oshawa silty clay loam (Oa).—This soil is on bottom lands along the Minnesota River. The following describes a profile:

Surface soil—
0 to 20 inches, dark-gray to very dark gray silty clay loam; weak fine granular structure; friable; mildly to moderately calcareous.
Underlying material—
20 to 40 inches, dark olive-gray to olive-gray silty clay loam; massive structure; friable; moderately calcareous.
40 inches +, olive-gray silty clay loam; massive structure; friable; moderately calcareous; white limy spots occur below 20 inches.

This soil is management group 23.

Peat and Muck Soils

Peat and Muck are organic soils located in very poorly drained scattered depressions in Scott County. The peat predominates; it has formed from sedges, reeds, and grasses in depressions that are wet much of the year.

Muck has undergone more decomposition than peat. It consists of a black or very dark brown organic soil comparatively high in mineral matter.

Peat and Muck, shallow, 0 to 2 percent slopes (PaA).—A shallow deposit of peat is normally underlain by mineral soil at depths ranging from 18 inches to 3 feet. However, in sections 11 and 12 of Eagle Creek Township, some shallow peat is underlain by sand; and in sections 3 and 4 of the same township, about 40 acres of shallow peat is underlain by limestone and sandstone bedrock. The peat in most bogs is brown, fibrous, and spongy and has undergone little decomposition. Management group 13.

Peat and Muck, shallow, 2 to 12 percent slopes (PaB).—This soil is similar to Peat and Muck, shallow, 0 to 2 percent slopes, but occurs in seepage areas at the base of bluffs or escarpments. Management group 13.

Peat, deep, 0 to 2 percent slopes (PbA).—This soil occurs in large bogs and is more than 3 feet deep to mineral material. It is not so decomposed as Peat and Muck, shallow. Many of these bogs are wet and marshy part of the year, but they ordinarily dry out about midsummer. Management group 13.

Peat, deep, 2 to 6 percent slopes (PbB).—This soil has formed at the base of bluffs or escarpments. The difference in slope distinguishes it from Peat, deep, 0 to 2 percent slopes. Management group 13.

Rauville Series

The Rauville are poorly drained, medium- to fine-textured soils on the bottom lands. They are darker colored than the Oshawa soils. The water table is always high. As a result, water stands on the soils for long periods following floods.

The natural vegetation is sedges, rushes, rank grasses, and some willows. In some of the wetter areas, the surface is covered by a 2- or 3-inch layer of fibrous peat or silty muck. Associated with the Rauville soils are the Comfrey soils, which are better drained. Only one soil of the Rauville series is mapped in Scott County.

Rauville silty clay loam (Ra).—This soil is on bottom lands along streams that flow into the Minnesota River. The following is a profile description:

Surface soil—
0 to 18 inches, black silty clay loam; weak fine granular structure; slightly sticky; neutral to mildly calcareous.
Underlying material—
18 inches +, very dark gray to dark gray silty clay loam; massive; slightly sticky; mildly calcareous.

This soil is in management group 23.

Sandstone Outcrops

Sandstone outcrops (Sa), as the name implies, are areas where sandstone bedrock is exposed, or where the soil mantle is 6 inches deep or less.

The areas are nearly level to steep. Agricultural use is limited to pasture, and little forage is obtained. Some of the sandstone is broken up for plaster sand and for use in sand-blasting machines. Management group 25.

Steep Land, Hayden-Lester Materials

Steep land, Hayden-Lester materials (Sb) occurs mostly as a narrow, steeply sloping belt stretching along the Minnesota River between the broad flood plains and the undulating or rolling uplands. Slopes are more than 34 percent. Included in this mapping unit are a few steep areas in the morainic hills in the eastern part of the county and some steep strips bordering tributary streams and surrounding some lakes. This land type consists mostly of Hayden and Lester soil materials that developed from glacial clay loam till. Areas making up less than 10 percent of the acreage of this land type contain pockets of gravelly or sandy Burnsville materials. The land type is too steep and broken for agricultural use. It supports a mixed hardwood forest that provides some grazing. Management group 24.

Stony Land

Stony land (Sc) is located chiefly on the terraces in St. Lawrence and Louisville Townships. It is non-agricultural land on slopes ranging from 1 to 36 percent. Limestone or sandstone bedrock underlies this land at depths of 6 to 36 inches. Numerous large granitic boulders are on the surface and throughout the profile. In some places the bedrock is exposed. Some areas of this land are on stony and gravelly ridges between lower areas of Copas or Faxon soils. Management group 25.

Terrace Escarpments

Terrace escarpments (Ta) are narrow, steeply sloping areas between the nearly level terraces and the bottom lands or between one terrace and another. Slopes are more than 12 percent. The material is sandy or gravelly and has little soil development.

Many areas on this land type support hardwood trees; other areas are in pasture. The trees are scrubby, and the grass in pastures is sparse. Overpasturing allows serious gullies to form. These gullies are difficult to control, and the loose sand and gravel disintegrate like sugar. Once gullying has started, vegetation is difficult or impossible to establish. It is useless to try to build control structures on this steep land, as there is no stable footing for them. Management group 25.

Terril Series

The Terril are gently sloping to sloping, well-drained upland soils developed from materials deposited by gravity and water. In places they occur on slopes between the steep bluffs and the river terraces. Calcareous clay loam glacial till similar to that underlying Clarion, Hayden, and Lester soils lies below 40 inches. Terril soils are dark to moderately dark. The original vegetation was prairie grasses, but hardwood forest occurs on these soils. Associated soils are the Clarion, Lester, Hayden, Lakeville, and Burnsville.

Terril sandy loam, 6 to 12 percent slopes (TbC).—The following describes a profile of this soil:

Surface soil—
0 to 28 inches, black to very dark brown sandy loam; somewhat cloddy; friable; neutral.
Underlying material—
28 inches +, very dark grayish-brown loamy sand streaked with dark grayish-brown; structureless; loose; neutral; clay loam till ordinarily reached at 48 inches.

The soil material is recently deposited alluvium and colluvium derived from higher lands. The higher land ordinarily is occupied by Lakeville soils or Lakeville-Burnsville soils mixed with Lester or Hayden soils. The finer materials are carried farther away, and the sandy portions settle out to form this soil. Management group 8.

Terril sandy loam, 0 to 6 percent slopes (TbB).—This nearly level to gently sloping soil has a profile similar to that described for Terril sandy loam, 6 to 12 percent slopes. Management group 3.

Terril sandy loam, 12 to 18 percent slopes (TbD).—This soil is similar to Terril sandy loam, 6 to 12 percent slopes, but has a greater degree of slope. Management group 15.

Terril sandy loam, 18 to 25 percent slopes (TbE).—In profile characteristics this steeply sloping soil is similar to Terril sandy loam, 6 to 12 percent slopes. Management group 22.

Terril silt loam, 6 to 12 percent slopes (TcC).—This sloping soil occurs in small strips below steeper areas of Lester and Hayden soils, and in large areas below the bluffs and above the river terraces. Included with the soil are a very few areas where seepage has produced an imperfectly drained soil. The following is a profile description of Terril silt loam, 6 to 12 percent slopes:

Surface soil—
0 to 19 inches, black silt loam; moderate fine to medium granular structure; friable; neutral.
Subsoil—
19 to 29 inches, very dark brown silt loam; moderate fine blocky structure; friable; neutral.
29 to 39 inches, very dark brown to very dark grayish-brown silt loam; moderate fine to medium blocky structure; friable; neutral.
39 to 47 inches, dark-brown silt loam; moderate fine to medium blocky structure; friable; neutral.
Underlying material—
47 inches +, olive-brown clay loam that is distinctly mottled; massive; slightly sticky; mildly to moderately calcareous.

This soil is in management group 7.

Terril silt loam, 0 to 2 percent slopes (TcA).—This nearly level soil is scattered throughout the uplands in areas where Clarion, Lester, and, in places, Hayden soils are dominant. It is similar to Terril silt loam, 6 to 12 percent slopes, in profile characteristics but is deeper and may be slightly less well drained. Management group 1.

Terril silt loam, 2 to 6 percent slopes (TcB).—This gently sloping soil occurs in small strips and patches below steeper areas of Clarion, Lester, and, in places, Hayden soils. It normally occupies strips between the highland and the Glencoe or Glencoe-Webster soils. In most profile characteristics, the soil is similar to Terril silt loam, 6 to 12 percent slopes. Management group 2.

Terril silt loam, 12 to 18 percent slopes (TcD).—Most of this moderately steep soil is along the Minnesota River. The areas are above the flood plains and terraces and below the narrow belt of bluffs. The profile is similar to that of Terril silt loam, 6 to 12 percent slopes, although the olive-brown calcareous glacial till normally lies nearer the surface. Management group 15.

Terril silt loam, 18 to 25 percent slopes (TcE).—Within areas of Terril silt loam, 12 to 18 percent slopes, are a few areas of this steeper Terril soil. The profile is similar to that of Terril silt loam, 6 to 12 percent slopes, but somewhat shallower. Management group 22.

Waukegan Series

The Waukegan are dark-colored soils that formed under tall native grasses on silty materials deposited over sandy river terraces and outwash plains. These well-drained soils are associated with the Estherville and Kasota soils. Their normal depth to sand is 32 to 36 inches, but the range is from 27 inches to more than 48 inches.

These soils differ from the Estherville in having a silty rather than a gritty (sandy) profile. Normally, these soils are nearly level, although small sloping areas adjoin drainageways or terrace escarpments. Erosion is slight except on the sloping areas.

Waukegan silt loam, 0 to 2 percent slopes (WaA).—This soil, along with Kasota silt loam, 0 to 2 percent slopes, is one of the best agricultural soils of the terraces. It has a more silty profile than the Kasota and lacks the firm clay layer. The following is a profile description:

Surface soil—
0 to 6 inches, black to very dark brown silt loam; weak fine granular and weak thin platy structure; friable; slightly acid.
Subsurface layer—
6 to 11 inches, dark-brown silt loam; weak fine blocky structure; friable; medium acid.
Subsoil—
11 to 16 inches, dark-brown silt loam; weak fine to medium blocky structure; very friable; medium acid.
16 to 24 inches, dark-brown silt loam; weak fine to medium blocky structure; very friable; strongly acid.
24 to 31 inches, olive-brown silt loam and very fine sandy loam; weak fine blocky structure; friable; neutral.
Underlying material—
31 inches +, light olive-brown gravel; structureless; loose; moderately calcareous; underlying material is sand in many places.

This soil is in management group 4.

Waukegan silt loam, 2 to 6 percent slopes (WaB).—This soil differs from Waukegan silt loam, 0 to 2 percent slopes, mainly in being more sloping. Management group 4.

Waukegan silt loam, 2 to 6 percent slopes, moderately eroded (WaB2).—This soil is similar to Waukegan silt loam, 0 to 2 percent slopes, but has stronger slopes and has lost 3 or 4 inches of the surface soil. Management group 4.

Waukegan silt loam, 6 to 12 percent slopes, slightly and moderately eroded (WaC2).—This soil is very similar to Waukegan silt loam, 0 to 2 percent slopes, except for having stronger slopes and eroded areas. It is very limited in acreage. Management group 9.

Waukegan silt loam, 12 to 18 percent slopes, moderately eroded (WaD2).—This moderately steep soil is limited to a very small acreage. It has the profile characteristics of Waukegan silt loam, 0 to 2 percent slopes, except that the surface layer is ordinarily somewhat lighter colored and thinner. Management group 16.

Webster Series

Webster soils are on the nearly level upland flats and in the upper drainageways of Scott County. The underlying material is the same type of calcareous clay loam glacial till as that under Clarion, Lester, or Hayden soils. The Webster soils are dark-colored, poorly drained, and intermediate in drainage between the LeSueur soils (moderately well drained) and the Glencoe soils (very poorly drained).

The original vegetation was tall prairie grasses and marsh bunchgrasses, but maple, basswood, elm, and oak forest were on these soils at the time of settlement. The Webster soils are not mapped alone in Scott County, but in complex with LeSueur or Glencoe soils.

Webster-LeSueur silty clay loams (Wc).—This complex occurs mainly on large flats in the western one-third of the county. The upland flats have a microrelief. On the slightly higher mounds are the better drained LeSueur soils, and in the depressions are the Webster. Approximately 25 percent of the complex is LeSueur, and 75 percent is Webster.

For a profile of the LeSueur soil, refer to LeSueur-Lester silt loams. The following is a profile of Webster silty clay loam:

Surface soil—
0 to 10 inches, black silty clay loam; moderate very fine to fine granular and blocky structure; friable; slightly acid.
Subsurface layer—
10 to 15 inches, black silty clay loam; moderate very fine to fine blocky structure; firm; medium acid.
Subsoil—
15 to 21 inches, very dark brown to very dark grayish-brown silty clay loam; moderate fine to medium blocky structure; firm; medium acid.
21 to 30 inches, grayish-brown clay loam to silty clay loam with distinct mottles; moderate fine blocky structure; very firm; medium acid.
Underlying material—
30 to 46 inches, olive-gray loam to clay loam with prominent mottling; massive; friable; neutral to mildly calcareous.
46 inches +, pale-olive clay loam with prominent mottles; massive; friable; moderately calcareous.

This soil is in management group 5.

Webster-Glencoe silty clay loams (Wb).—In upper drainageways within the Clarion, Webster-LeSueur, Lester, and sometimes Hayden soil areas, are mixed areas of Webster and Glencoe soils. These areas range from moderately well to very poorly drained and are therefore mapped as a complex of Webster and Glencoe soils. Most of these soil areas receive a small amount of material washed from surrounding higher land. These wet areas tend to extend like fingers up through better drained land. They create a tillage problem for the farmer because his machinery frequently gets stuck. A few seepage spots with more than 3 percent slope have been included in this area. For the profile characteristics of Glencoe and Webster soils, see Glencoe silty clay loam and Webster-LeSueur silty clay loams. Management group 11.

Zimmerman Series

Zimmerman soils are light-colored, windblown sands on the timbered terraces between Shakopee and Savage. Associated with Zimmerman in the depressions and lower flats are the very poorly drained Isanti and the somewhat poorly drained Duelm soils. Surrounding the wooded Zimmerman soils are the dark-colored sands of the Hubbard soils.

Wind erosion is active and has caused severe erosion in many places. The topography has the characteristic low, dunelike appearance of windblown soils. The sands were originally deposited by water but were reworked by wind before they were stabilized by vegetation.

Zimmerman soils are subject to severe drought, as they have little moisture-holding capacity. Their natural vegetation consists of scrub oak, mostly bur and scarlet.

Zimmerman fine sand, 2 to 6 percent slopes (ZaB).—This soil has a low, dunelike topography. Wind erosion is slight in most places, but the soil is very droughty. The following is a profile description:

Surface soil—
0 to 6 inches, dark grayish-brown fine sand; structureless; loose; medium acid.
Subsurface layer—
6 to 10 inches, grayish-brown fine sand; structureless; loose; medium acid.
Subsoil—
10 to 16 inches, yellowish-brown sand; structureless; loose; strongly acid.
16 to 26 inches, brownish-yellow sand; structureless; loose; strongly acid.
Underlying material—
26 to 30 inches, brownish-yellow sand; structureless; loose; strongly acid.
30 inches +, very pale brown sand; structureless; loose; medium acid.

This soil is in management group 26.

Zimmerman fine sand, 0 to 2 percent slopes (ZaA).—This nearly level soil has a profile similar to that of Zimmerman fine sand, 2 to 6 percent slopes. Slight wind erosion has occurred nearly everywhere. The soil is very droughty. Management group 26.

Zimmerman fine sand, 0 to 2 percent slopes, moderately wind eroded (ZaA2).—This soil has a profile similar to that of Zimmerman fine sand, 2 to 6 percent slopes, but has lost 3 to 4 inches of surface soil through wind erosion. The soil is very droughty. Management group 26.

Zimmerman fine sand, 2 to 6 percent slopes, moderately wind eroded (ZaB2).—This soil is very similar to Zimmerman fine sand, 2 to 6 percent slopes, but has lost 3 to 4 inches of surface soil through wind erosion. Management group 26.

Zimmerman fine sand, 6 to 12 percent slopes, slightly and moderately eroded (ZaC2).—The profile of this soil is similar to that of Zimmerman fine sand,

2 to 6 percent slopes. Where wind has disturbed the surface, the soil is light colored and the supply of organic matter is low. Wind erosion varies from slight to moderate. Management group 26.

Use and Management of Soils

This section has five main parts. The first explains the system the Soil Conservation Service uses to group soils according to their capability. The second lists the soils in each management group and suggests how each group of soils can be used and managed. The suggested management is summarized in table 2 for easy reference. The third part provides estimated yields of the principal crops on each soil. The fourth lists some general suggestions for management of soils used for pasture, woodland, or wildlife areas. The fifth gives some information on irrigation and drainage.

Capability Groups

Capability grouping is a system of classification used to show the relative suitability of soils for crops, grazing, forestry, and wildlife. It is a practical grouping based on the needs, limitations, and risks of damage to the soils, and also on their response to management. There are three levels above the soil mapping unit in the grouping—units, subclass, and class.

The capability unit, equivalent to a management group in this county, is the lowest level of grouping. A capability unit is made up of soils similar in kind of management they need, in risk of damage, and in general suitability for use.

The next broader grouping, the subclass, is used to indicate the dominant kind of limitation. The letter symbol "e" indicates that the main limiting factor is risk of erosion if the plant cover is not maintained; "w" means excess water that retards plant growth or interferes with cultivation; and "s" shows that the soils are shallow, droughty, or unusually low in fertility.

The broadest grouping, the land class, is identified by Roman numerals. All the soils in one class have limitations and management problems of about the same degree, but of different kinds, as shown by the subclass. All the land classes except class I may have one or more subclasses.

In classes I, II, and III are soils that are suitable for annual or periodic cultivation of annual or short-lived crops. Class I soils are those that have the widest range of use and the least risk of damage. They are level, or nearly level, productive, well drained, and easy to work. They can be cultivated with almost no risk of erosion and will remain productive if managed with normal care.

Class II soils can be cultivated regularly but do not have quite so wide a range of suitability as class I soils. Some class II soils are gently sloping; consequently, they need moderate care to prevent erosion. Other soils in class II may be slightly droughty, or slightly wet, or somewhat limited in depth.

Class III soils can be cropped regularly but have a narrower range of use. These need even more careful management.

In class IV are soils that should be cultivated only occasionally or only under very careful management.

In classes V, VI, and VII are soils that normally should not be cultivated for annual or short-lived crops, but they can be used for pasture and range, as woodland, or for wildlife.

Class V soils are nearly level and gently sloping but are droughty, wet, low in fertility, or otherwise unsuitable for cultivation.

Class VI soils are not suitable for crops because they are steep, or droughty, or otherwise limited; but they give fair yields of forage or forest products. Some soils in class VI can, without damage, be cultivated enough so that fruit trees or forest trees can be set out or pasture crops seeded.

Class VII soils provide only poor to fair yields of forage or forest products.

In class VIII are soils that have practically no agricultural use. Some of them have value for watersheds, wildlife habitats, or scenery.

The capability classes, subclasses, and management groups in Scott County are listed and defined as follows:

Class I. Soils that are easy to farm and have no serious limitations to use.
  Management group:
    1. Deep nearly level fertile soils.

Class II. Soils that have moderate limitations if cultivated.
  IIe. Nearly level or gently sloping soils.
    Management group:
      2. Deep fertile soils.
      3. Deep moderately fertile soils.
      4. Dark fertile soils moderately deep to sand or gravel.
  IIw. Soils that are slightly wet or subject to occasional overflow.
    Management group:
      5. Dark nearly level upland soils.
      6. Soils of the bottom lands that are occasionally flooded.

Class III. Soils that have severe limitations if cultivated.
  IIIe. Sloping soils subject to erosion.
    Management group:
      7. Deep dark silty soils.
      8. Deep light-colored loamy soils.
      9. Dark soils moderately deep to sand or gravel.
      10. Dark soils moderately shallow to bedrock.
  IIIw. Somewhat poorly to very poorly drained soils.
    Management group:
      11. Moderately fine textured nearly level soils.
      12. Moderately coarse textured nearly level soils.
      13. Organic soils.

IIIs. Excessively drained soils.
Management group:
14. Dark soils moderately shallow to sand or gravel.

Class IV. Soils fairly well suited to limited or occasional cultivation under careful management.
IVe. Moderately steep or steep soils subject to erosion.
Management group:
15. Deep silty and loamy soils.
16. Loamy and silty soils moderately deep to sand or gravel.
IVs. Excessively drained or droughty soils.
Management group:
17. Sloping excessively drained loamy soils.
18. Nearly level to gently sloping sandy soils.
19. Sloping sandy soils.
20. Nearly level to gently sloping gravelly soils.

Class V. Level or gently sloping soils not suitable for cultivation but having no outstanding limitations if used for pasture or woodland.
Vw. Poorly drained or very poorly drained nearly level soils.
Management group:
21. Hummocky soil that is shallow to bedrock and contains many boulders.

Class VI. Soils suitable for pasture or trees but not suitable for cultivation except under unusually careful management.
VIe. Moderately steep or steep erodible soils.
Management group:
22. Light to moderately dark colored loamy or silty soils.
VIw. Poorly drained soils of the flood plains.
Management group:
23. Soils that are frequently flooded.

Class VII. Soils severely limited for use as pasture or woodland.
VIIe. Steep or very steep, erodible, excessively drained soils.
Management group:
24. Eroded and excessively drained soils.
VIIs. Sloping to very steep droughty soils.
Management group:
25. Gravelly soils, stony land, and terrace escarpments.
26. Deep droughty sands.

Class VIII. Soils suitable for wildlife, watersheds, or recreation but not suitable for commercial vegetation.
VIIIw. Wet areas that support grasses or grasslike plants.
Management group:
27. Marsh.

Management Groups

As shown in table 2, the soils of Scott County have been placed in 27 management groups. All the soils in one group have similar limitations and risk of damage, and they respond to management in about the same way.

MANAGEMENT GROUP 1

Deep nearly level fertile soils (I):

LeSueur silt loam.
LeSueur-Lester silt loams.
Terril silt loam, 0 to 2 percent slopes.

In this group are moderately dark colored, moderately well drained to well drained silt loams of the uplands and colluvial slopes. Although these soils are ideally suited to corn and soybeans, the tendency has been to keep them in corn too much of the time.

Good rotations would improve yields, increase the depleted supply of organic matter, and improve the tilth of the soils. Rotations having 1 year of legume-grass meadow in each 4 to 6 years, or 2 years of meadow in 6, are suitable, provided lime and fertilizer are applied in accordance with soil tests and all crop residues are returned to the soil. Examples of such crop sequences are 3 years of corn, 1 year of small grain, and 2 years of meadow; 4 years of corn, 1 year of small grain, and 1 year of meadow; and 2 years of corn or soybeans, 1 year of a small grain, and meadow for 1 year. Crop rotations of the kind just listed will protect and maintain the soils if only the ordinary practices of good farming are followed.

Some of the soils in this group are in permanent pasture or wooded, but the pastures produce little forage because they are poorly managed. It is suggested that permanent pastures and thinly wooded pastures be cleared of trees and used as rotation cropland.

The trees on the soils of management group 1 are hard maple, red and American elm, basswood, black cherry, oak, and white ash. If these soils are left as woodland, hard maple, red elm, basswood, white oak, and white ash should be encouraged. Open areas can be planted to white pine.

Odd areas can be planted to provide food and cover for wildlife. The suggested evergreens are white pine, white and Norway spruce, and redcedar. Honeysuckle, lilac, crabapple, and similar shrubs are suitable. In the interest of good long-term use, these soils ought to be cleared of trees and used as cropland.

MANAGEMENT GROUP 2

Deep fertile soils (IIe):

Clarion silt loam, 2 to 6 percent slopes.
Clarion silt loam, 2 to 6 percent slopes, moderately eroded.
Lester silt loam, 2 to 6 percent slopes.
Lester silt loam, 2 to 6 percent slopes, moderately eroded.
Terril silt loam, 2 to 6 percent slopes.

These are dark and moderately dark, medium-textured, well-drained, moderately permeable silt loams of the uplands (fig. 8). To maintain fertility and soil structure with no conserving practices other than crop rotation, these soils should be kept in grass-legume meadow a third of the time. Slopes more than 300 feet long ought to be terraced or stripcropped. If terraces are used, a rotation that furnishes 1 year of legume-grass meadow in 5 years is suitable. If stripcropping is practiced, alternate strips should be in hay. Appropriate for stripcropped areas is a 6-year rotation consisting of 2 years of corn or other row crop, 1 year of small grain, and 3 years of alfalfa-

TABLE 2.—*Soils of Scott County arranged by management*

Management group	No mechanical practices	Contour farming
Group 1: Deep nearly level fertile soils (I) LeSueur silt loam. LeSueur-Lester silt loams. Terril silt loam, 0 to 2 percent slopes.	4 years row crops, 1 year small grain, and 1 year meadow. 3 years row crops, 1 year small grain, and 2 years meadow. 2 years row crops, 1 year small grain, and 1 year meadow.	----------
Group 2: Deep fertile soils (IIe) Clarion silt loam, 2 to 6 percent slopes. Clarion silt loam, 2 to 6 percent slopes, moderately eroded. Lester silt loam, 2 to 6 percent slopes. Lester silt loam, 2 to 6 percent slopes, moderately eroded. Terril silt loam, 2 to 6 percent slopes.	1 year row crop, 1 year small grain, and 1 year meadow.	2 years row crops, 1 year small grain, and 1 year meadow.
Group 3: Deep moderately fertile soils (IIe) Burnsville, Hayden, Kingsley, and Scandia loams, 0 to 6 percent slopes. Hayden loam, 0 to 6 percent slopes. Hayden loam, 2 to 6 percent slopes, moderately eroded. Hayden sandy loam, 0 to 6 percent slopes. Hayden sandy loam, 0 to 6 percent slopes, moderately eroded. Terril sandy loam, 0 to 6 percent slopes.	1 year row crop, 1 year small grain, and 2 years meadow.	2 years row crops, 1 year small grain, and 1 year meadow. 2 years row crops, 1 year small grain, and 2 years meadow.
Group 4: Dark fertile soils moderately deep to sand or gravel (IIe). Dakota loam, 0 to 2 percent slopes. Dakota loam, 2 to 6 percent slopes. Dakota loam, 2 to 6 percent slopes, moderately eroded. Kasota silt loam, 0 to 2 percent slopes. Kasota silt loam, 2 to 6 percent slopes. Lakeville loam, 0 to 2 percent slopes. Lakeville loam, 2 to 6 percent slopes. Lakeville loam, 2 to 6 percent slopes, moderately eroded. Waukegan silt loam, 0 to 2 percent slopes. Waukegan silt loam, 2 to 6 percent slopes. Waukegan silt loam, 2 to 6 percent slopes, moderately eroded.	3 years row crops, 1 year small grain, and 1 year meadow (for use on 0 to 2 percent slopes). 1 year row crop, 1 year small grain, and 1 year meadow. 1 year row crop, 1 year small grain, and 2 years meadow (for use on 2 to 6 percent slopes).	2 years row crops, 1 year small grain, and 1 year meadow (for use on 2 to 6 percent slopes).
Group 5: Dark nearly level upland soils (IIw) Dundas silt loam, 0 to 2 percent slopes. Webster-LeSueur silty clay loams.	4 years row crops, 1 year small grain, and 1 year meadow. 3 years row crops, 1 year small grain, and 1 year meadow.	----------
Group 6: Soils of the bottom lands that are occasionally flooded (IIw). Comfrey silty clay loam. Dorchester loam and silt loam. Dorchester silty clay loam. Alluvial land, 0 to 2 percent slopes. Alluvial land, 2 to 6 percent slopes.	Row crops	----------
Group 7: Deep, dark silty soils (IIIe) Clarion silt loam, 6 to 12 percent slopes. Clarion silt loam, 6 to 12 percent slopes, moderately eroded. Lester silt loam, 6 to 12 percent slopes. Lester silt loam, 6 to 12 percent slopes, moderately eroded. Terril silt loam, 6 to 12 percent slopes.	1 year row crop, 1 year small grain, and 4 years meadow.	1 year row crop, 1 year small grain, and 2 years meadow.
Group 8: Deep light-colored loamy soils (IIIe) Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes. Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes, moderately eroded. Hayden loam, 6 to 12 percent slopes. Hayden loam, 6 to 12 percent slopes, moderately eroded. Hayden sandy loam, 6 to 12 percent slopes. Hayden sandy loam, 6 to 12 percent slopes, moderately eroded. Terril sandy loam, 6 to 12 percent slopes.	1 year row crop, 1 year small grain, and 4 years meadow.	1 year row crop, 1 year small grain, and 3 years meadow.

Footnote at end of table.

groups and suitable cropping systems and supporting practices[1]

Contour stripcropping	Wind stripcropping	Terracing	Remarks
			Some areas in woods or pasture can be converted to crops.
2 years row crops, 1 year small grain, and 3 years meadow; or 1 year row crop, 1 year small grain, and 2 years meadow.		3 years row crops, 1 year small grain, and 1 year meadow; or 3 years row crops, 1 year small grain, and 2 years meadow.	If stripcropping is used, alternate strips should be in hay. Stripcropping or terracing is mandatory on slopes more than 300 feet long.
1 year row crop, 1 year small grain, and 2 years meadow.		3 years row crops, 1 year small grain, and 2 years meadow. 1 year row crop, 1 year small grain, and 1 year meadow.	If stripcropping is used, alternate strips should be in hay. Stripcropping or terracing is mandatory on slopes more than 300 feet long.
1 year row crop, 1 year small grain, and 2 years meadow (for use on 2 to 6 percent slopes).		4 years row crops, 1 year small grain, and 1 year meadow (for use on 2 to 6 percent slopes). 1 year row crop, 1 year small grain, and 1 year meadow.	If stripcropping is used, alternate strips should be in hay. Stripcropping or terracing is mandatory on slopes more than 300 feet long.
			Install tile drainage; convert woods and pasture to tilled crops.
			Hay can be grown as needed.
1 year row crop, 1 year small grain, and 2 years meadow.		2 years row crops, 1 year small grain, and 1 year meadow. 1 year row crop, 1 year small grain, and 1 year meadow.	
1 year row crop, 1 year small grain, and 2 years meadow.		2 years row crops, 1 year small grain, and 1 year meadow. 1 year row crop, 1 year small grain, and 1 year meadow.	Apply manure to eroded areas first.

TABLE 2.—*Soils of Scott County arranged by management groups*

Management group	No mechanical practices	Contour farming
Group 9: Dark soils moderately deep to sand or gravel (IIIe). Dakota loam, 6 to 12 percent slopes, moderately eroded. Lakeville loam, 6 to 12 percent slopes. Lakeville loam, 6 to 12 percent slopes, moderately eroded. Waukegan silt loam, 6 to 12 percent slopes, slightly and moderately eroded.	1 year row crop, 1 year small grain, and 4 years meadow.	1 year row crop, 1 year small grain, 3 years meadow.
Group 10: Dark soils moderately shallow to bedrock (IIIe). Copas silt loam, 0 to 2 percent slopes. Copas silt loam, 2 to 6 percent slopes. Copas silt loam, 2 to 6 percent slopes, moderately eroded.	2 years row crops, 1 year small grain, and 1 year meadow (for use on 0 to 2 percent slopes). 1 year row crop, 1 year small grain, and 3 years meadow (for use on 2 to 6 percent slopes).	1 year row crop, 1 year small grain, and 1 year meadow (for use on 2 to 6 percent slopes).
Group 11: Moderately fine textured nearly level soils (IIIw). Blue Earth silty clay loam, 0 to 3 percent slopes. Glencoe silty clay loam. Webster-Glencoe silty clay loams.	4 years row crops, 1 year small grain, and 1 year meadow. 3 years row crops, 1 year small grain, and 2 years meadow.	----------
Group 12: Moderately coarse textured nearly level soils (IIIw). Duelm fine sandy loam, 0 to 3 percent slopes. Isanti fine sandy loam.	2 years row crops, 1 year small grain, and 2 years meadow. 1 year row crop, 1 year small grain, and 1 year meadow.	----------
Group 13: Organic soils (IIIw) Beach materials and Muck. Peat, deep, 0 to 2 percent slopes. Peat, deep, 2 to 6 percent slopes. Peat and Muck, shallow, 0 to 2 percent slopes. Peat and Muck, shallow, 2 to 12 percent slopes.	No rotation suggested; soils can be used for silage corn, sweet corn, soybeans, flax, small grains, and mixed hay.	----------
Group 14: Dark soils moderately shallow to sand or gravel (IIIs). Dakota sandy loam, 0 to 2 percent slopes. Dakota sandy loam, 2 to 6 percent slopes. Dakota sandy loam, 2 to 6 percent slopes, moderately eroded. Estherville loam and sandy loam, 0 to 2 percent slopes. Estherville loam and sandy loam, 2 to 6 percent slopes. Estherville loam and sandy loam, 2 to 6 percent slopes, moderately eroded.	2 years row crops, 1 year small grain, and 1 year meadow (for use on 0 to 2 percent slopes). 1 year row crop, 1 year small grain, and 1 year meadow. 2 years row crops, 1 year small grain, and 2 years meadow (for use on 2 to 6 percent slopes).	2 years row crops, 1 year small grain, and 1 year meadow (for use on 2 to 6 percent slopes).
Group 15: Deep silty and loamy soils (IVe) Burnsville, Hayden, Kingsley, and Scandia loams, 12 to 18 percent slopes. Burnsville, Hayden, Kingsley, and Scandia loams, 12 to 18 percent slopes, moderately eroded. Clarion soils, 6 to 12 percent slopes, severely eroded. Hayden soils, 6 to 12 percent slopes, severely eroded. Hayden loam, 12 to 18 percent slopes Hayden loam, 12 to 18 percent slopes, moderately eroded. Hayden sandy loam, 12 to 18 percent slopes. Hayden sandy loam, 12 to 18 percent slopes, moderately eroded. Lester soils, 6 to 12 percent slopes, severely eroded. Lester silt loam, 12 to 18 percent slopes. Lester silt loam, 12 to 18 percent slopes, moderately eroded. Terril silt loam, 12 to 18 percent slopes. Terril sandy loam, 12 to 18 percent slopes.	1 year small grain and 3 years meadow	1 year small grain and 3 years meadow 1 year small grain and 2 years meadow

Footnote at end of table.

and suitable cropping systems and supporting practices—Continued

Contour stripcropping	Wind stripcropping	Terracing	Remarks
1 year row crop, 1 year small grain, 2 years meadow.		2 years row crops, 1 year small grain, 1 year meadow.	Prevent gullies from forming. Woodland can be improved by interplanting. Wildlife areas can be established in gravel pits.
1 year row crop, 1 year small grain, and 2 years of meadow (for use on 2 to 6 percent slopes).		Not advisable	Treat pastures with nitrogen or a complete fertilizer; spray weeds and woody growth; rotate grazing.
			Use tile or open-ditch drainage; apply potash and organic matter to high-lime spots; undrained pasture can be improved in fall; seed drainage ditchbanks to grasses and legumes for wildlife.
			Use open-ditch drainage; improve undrained pasture by working it in the dry season, then fertilizing with phosphate and potash, and reseeding to reed canarygrass.
			Use tile and open-ditch drainage and apply phosphate and potash; undrained pasture can be improved by working in a dry season, applying phosphate and potash, and seeding to reed canarygrass.
1 year row crop, 1 year small grain, and 2 years meadow (for use on 2 to 6 percent slopes).	2 years row crops, 1 year small grain, and 1 year meadow (for use on 2 to 6 percent slopes).	Not advisable	Plow down green manure in spring; permanent pasture not advisable but soils can provide supplemental rotation pasture; Christmas trees particularly suited; gravel pits may be improved for wildlife.
1 year row crop, 1 year small grain, and 3 years meadow. 1 year row crop, 1 year small grain, and 4 years meadow.		Not advisable on slopes greater than 12 percent.	Topdress hay with phosphate-potash fertilizer after first cutting of second year; pastures should be renovated.

TABLE 2.—*Soils of Scott County arranged by management groups*

Management group	No mechanical practices	Contour farming
Group 16: Loamy and silty soils moderately deep to sand or gravel (IVe). Lakeville loam, 12 to 18 percent slopes. Lakeville loam, 12 to 18 percent slopes, moderately eroded. Waukegan silt loam, 12 to 18 percent slopes, moderately eroded.	1 year small grain and 3 years meadow	1 year small grain and 3 years meadow
Group 17: Sloping excessively drained loamy soils (IVs). Dakota sandy loam, 6 to 12 percent slopes, moderately eroded. Estherville loam and sandy loam, 6 to 12 percent slopes. Estherville loam and sandy loam, 6 to 12 percent slopes, moderately eroded.	1 year row crop, 1 year small grain, and 2 years meadow.	2 years row crops, 1 year small grain, and 2 years meadow.
Group 18: Nearly level to gently sloping sandy soils (IVs). Hubbard loamy fine sand, 0 to 2 percent slopes. Hubbard loamy fine sand, 2 to 6 percent slopes. Hubbard loamy fine sand, 2 to 6 percent slopes, moderately wind eroded.	2 years row crops, 1 year small grain, and 2 years meadow (for use on 2 to 6 percent slopes).	2 years row crops, 1 year small grain, and 2 years meadow (for use on 2 to 6 percent slopes).
Group 19: Sloping sandy soils (IVs) Hubbard loamy fine sand, 6 to 12 percent slopes. Hubbard loamy fine sand, 6 to 12 percent slopes, moderately eroded.	1 year row crop, 1 year small grain, and 3 years meadow.	1 year row crop, 1 year small grain, and 1 year meadow.
Group 20: Nearly level to gently sloping gravelly soils (IVs). Estherville gravelly sandy loam, 0 to 6 percent slopes. Estherville gravelly sandy loam, 0 to 6 percent slopes, moderately eroded. Lakeville-Burnsville gravelly sandy loams, 0 to 6 percent slopes. Lakeville-Burnsville gravelly sandy loams, 0 to 6 percent slopes, moderately eroded.	1 year row crop, 1 year small grain, and 1 year meadow (for use on 2 to 6 percent slopes).	2 years row crops, 1 year small grain, and 1 year meadow.
Group 21: Hummocky soil that is shallow to bedrock and contains many boulders (Vw). Faxon silty clay loam, 0 to 6 percent slopes.	Permanent pasture	
Group 22: Light to moderately dark colored loamy or silty soils (VIe). Burnsville, Hayden, Kingsley, and Scandia soils, 12 to 18 percent slopes, severely eroded. Burnsville, Hayden, Kingsley, and Scandia loams, 18 to 25 percent slopes, slightly and moderately eroded. Hayden soils, 12 to 18 percent slopes, severely eroded. Hayden loam, 18 to 25 percent slopes, slightly and moderately eroded. Hayden sandy clay loam, 12 to 18 percent slopes, severely eroded. Hayden sandy loam, 18 to 25 percent slopes, slightly and moderately eroded. Lester soils, 12 to 18 percent slopes, severely eroded. Lester silt loam, 18 to 25 percent slopes, slightly and moderately eroded. Terril sandy loam, 18 to 25 percent slopes. Terril silt loam, 18 to 25 percent slopes.	Permanent pasture or woodland	
Group 23: Soils that are frequently flooded (VIw). Alluvial land, frequent overflow, 0 to 6 percent slopes. Oshawa silty clay loam. Rauville silty clay loam.		

Footnote at end of table.

and suitable cropping systems and supporting practices—Continued

Contour stripcropping	Wind stripcropping	Terracing	Remarks
1 year row crop, 1 year small grain, and 4 years meadow.		Not advisable	Topdress hay stands with phosphate-potash fertilizer after first cutting of second year; pasture should be renovated; prevent gullies from forming; improve woods by interplanting; improve gravel pits for wildlife.
1 year row crop, 1 year small grain, and 2 years meadow.		Not advisable	Plow green manure under in spring; permanent pasture not advisable, but can be used for supplemental pasture; Christmas trees particularly suited to these soils; improve gravel pits for wildlife.
1 year row crop, 1 year small grain, and 2 years meadow.	2 years row crops, 1 year small grain, and 2 years meadow (for use on 0 to 2 percent slopes).	Not advisable	Plant shelterbelts of pine every 40 rods and use stubble-mulch tillage; plow only in spring and maintain year-round cover; land is particularly suitable for Christmas trees; not suited to permanent pasture.
1 year row crop, 1 year small grain, and 2 years meadow.		Not advisable	Plant shelterbelts of pine every 40 rods and use stubble-mulch tillage; plow only in spring and provide year-round cover; soils are particularly suited to growing Christmas trees but not suited to use as permanent pasture.
1 year row crop, 1 year small grain, and 2 years meadow.	2 years row crops, 1 year small grain, and 1 year meadow (for use on 0 to 2 percent slopes).	Not advisable	Soils do not make good permanent pasture; plant to pines; gravel pits can be developed for wildlife.
			Add nitrogen and spray weeds and brush.
			Renovate pastures; improve woods by underplanting adapted species; develop odd areas and isolated steep spots for wildlife.
			Suited to pasture, wild hay, or wildlife.

TABLE 2.—*Soils of Scott County arranged by management groups*

Management group	No mechanical practices	Contour farming
Group 24: Eroded and excessively drained soils (VIIe). Burnsville, Hayden, Kingsley, and Scandia soils, 18 to 25 percent slopes, severely eroded. Burnsville, Hayden, Kingsley, and Scandia loams, 25 to 50 percent slopes. Hayden soils, 18 to 25 percent slopes, severely eroded. Hayden loam, 25 to 35 percent slopes, slightly and moderately eroded. Hayden sandy clay loam, 18 to 25 percent slopes, severely eroded. Hayden sandy loam, 25 to 35 percent slopes, slightly and moderately eroded. Lester soils, 18 to 25 percent slopes, severely eroded. Lester silt loam, 25 to 35 percent slopes, slightly and moderately eroded. Lester soils, 25 to 35 percent slopes, severely eroded. Steep land, Hayden-Lester materials.	Woodland or limited permanent pasture	
Group 25: Gravelly soils, stony land, and terrace escarpments (VIIs). Estherville gravelly sandy loam, 6 to 12 percent slopes. Estherville gravelly sandy loam, 6 to 12 percent slopes, moderately eroded. Lakeville-Burnsville gravelly sandy loams, 6 to 12 percent slopes. Lakeville-Burnsville gravelly sandy loams, 6 to 12 percent slopes, moderately eroded. Lakeville-Burnsville gravelly sandy loams, 12 to 50 percent slopes. Sandstone outcrops. Stony land. Terrace escarpments.	Suitable for growing pines, except for Sandstone outcrops and Stony land	
Group 26: Deep, droughty sands (VIIs) Beach materials, sandy. Dune land. Hubbard fine sand, 0 to 2 percent slopes. Hubbard fine sand, 2 to 6 percent slopes. Hubbard fine sand, 2 to 6 percent slopes, moderately wind eroded. Hubbard fine sand, 6 to 12 percent slopes. Hubbard fine sand, 6 to 12 percent slopes, moderately wind eroded. Zimmerman fine sand, 0 to 2 percent slopes. Zimmerman fine sand, 0 to 2 percent slopes, moderately wind eroded. Zimmerman fine sand, 2 to 6 percent slopes. Zimmerman fine sand, 2 to 6 percent slopes, moderately wind eroded. Zimmerman fine sand, 6 to 12 percent slopes, slightly and moderately eroded.	Pines can be grown	
Group 27: Marsh (VIII)		

[1] Rotations given first in a column are the most intensive for safe use under average length of slope and percent of slope. Other less intensive rotations may maintain tilth better or improve drainage conditions. Additional information on management practices will be found throughout the section, Use and Management of Soils.

and suitable cropping systems and supporting practices—Continued

Contour stripcropping	Wind stripcropping	Terracing	Remarks
			Suitable for limited permanent pasture; plant open areas in woods to adapted species.
			Develop small odd areas and gravel pits for wildlife; soils not suitable for pasture but Sandstone outcrops and Stony land can be pastured sparingly.
			Not suitable for permanent pasture; cropping feasible only with irrigation; before planting Dune land to pines, spread straw and disk.
			May be used as a wildlife habitat.

Figure 8.—Clarion and Webster-LeSueur soils. Capability class II.

bromegrass meadow; or a rotation of 1 year of corn, 1 year of small grain, and 2 years of meadow. Whether the soils are terraced or stripcropped, lime, phosphate, and potash are needed in amounts shown by soil tests. The need for nitrogen will depend on the cropping system used.

Permanent pasture and woodland need the same management as that described for soils of management group 1.

MANAGEMENT GROUP 3

Deep moderately fertile soils (IIe):

Burnsville, Hayden, Kingsley, and Scandia loams, 0 to 6 percent slopes.
Hayden loam, 0 to 6 percent slopes.
Hayden loam, 2 to 6 percent slopes, moderately eroded.
Hayden sandy loam, 0 to 6 percent slopes.
Hayden sandy loam, 0 to 6 percent slopes, moderately eroded.
Terril sandy loam, 0 to 6 percent slopes.

In this group are dominantly light-colored, well-drained, moderately permeable loams and sandy loams of the uplands. They are lower in fertility and organic matter than the soils of groups 1 and 2, but by use of good farming practices their productivity can be increased above that which they had when first cultivated. The slopes are complex in many places and therefore not suitable for terracing or stripcropping. Nevertheless, a good crop rotation will increase yields and maintain soil structure. A rotation suitable without supplementary conserving practices is corn, a small grain, and 2 years of legume-grass meadow. Where practicable, of course, this rotation should be supplemented by stripcropping or terracing. Terraced lands may be farmed with a rotation made up of 3 years of row crops, 1 year of small grain, and 2 years of meadow. Lime, phosphate, and potash should be applied in accordance with soil tests. Crop residues ought to be returned to the soils.

MANAGEMENT GROUP 4

Dark fertile soils moderately deep to sand or gravel (IIe):

Dakota loam, 0 to 2 percent slopes.
Dakota loam, 2 to 6 percent slopes.
Dakota loam, 2 to 6 percent slopes, moderately eroded.
Kasota silt loam, 0 to 2 percent slopes.
Kasota silt loam, 2 to 6 percent slopes.
Lakeville loam, 0 to 2 percent slopes.
Lakeville loam, 2 to 6 percent slopes.
Lakeville loam, 2 to 6 percent slopes, moderately eroded.
Waukegan silt loam, 0 to 2 percent slopes.
Waukegan silt loam, 2 to 6 percent slopes.
Waukegan silt loam, 2 to 6 percent slopes, moderately eroded.

These are dark-colored, moderately permeable, somewhat excessively drained to well drained loams and silt loams of the uplands and terraces. The soils on slopes of 0 to 2 percent are intensively cropped to corn, oats, and soybeans. Little hay is grown. The level areas of these soils can be maintained if they are in hay 1 year in 5, provided all crop residues are returned to the soils, lime and fertilizer are applied in accordance with soil tests, and other ordinary good farming practices are followed. If all crop residues are not returned and smaller applications of lime and fertilizer are used, hay ought to be on these soils one-fourth to one-third of the time.

More intensive management is needed on the soils with slopes of 2 to 6 percent than on the nearly level soils. On the stronger slopes a rotation made up of corn, a small grain, and 2 years of alfalfa-bromegrass meadow is appropriate, provided contour stripcropping is practiced. If stripcropping is used, alternate strips should be in hay. If the soils on slopes of 2 to 6 percent are terraced, the rotation suggested for the nearly level soils can be used. The need for lime and fertilizer should be determined by soil tests.

MANAGEMENT GROUP 5

Dark nearly level upland soils (IIw):

Dundas silt loam, 0 to 2 percent slopes.
Webster-LeSueur silty clay loams.

In this group are deep, moderately slowly permeable, somewhat poorly to poorly drained silt loam and silty clay loam soils of the uplands.

If these soils are to produce maximum yields, they must have tile drainage. The Dundas soil, normally somewhat poorly drained because it has a slowly permeable subsoil, may require surface inlets to improve drainage. Rotations employing deep-rooted legumes will increase the efficiency of the tile systems.

Suitable for the soils of this group is a rotation made up of 3 years of corn or soybeans, a small grain, and 1 or 2 years of meadow. If a rotation consisting of 4 years of corn, a small grain, and 1 year of meadow is followed, careful management of crop residues and high fertilization must be practiced to prevent deterioration of structure. If soil structure is damaged, the efficiency of the tile system decreases. Canning crops can be substituted in the rotations for corn or soybeans. The soils should be tested, since the limy spots will require special treatment with potash and phosphate for good crop growth. These soils can be made very productive by good management.

A considerable area of this management group is in permanent pasture or thinly wooded pasture. The pastures are now producing little because of poor management. It would be advisable to clear the trees,

install tile drainage, and use the soils as rotation cropland. Nevertheless, productive pastures can be obtained by liming, fertilizing, and seeding suitable forage plants.

The trees on the wooded areas are hard maple, red and American elm, basswood, oak, white ash, and black cherry. If these soils are left in woods, growth of hard maple, red elm, basswood, white oak, and white ash should be encouraged. Open areas can be planted to white pine. For highest returns, however, it would be better to use these soils as cropland.

Odd areas can be planted to provide food and cover for wildlife. Evergreens, shrubs, legumes, and grasses should be in the plantings. Sweetclover is the best legume. Suitable evergreens are white pine, white and Norway spruce, and redcedar. Among the suitable shrubs are honeysuckle, lilac, and crabapple.

MANAGEMENT GROUP 6

Soils of the bottom lands that are occasionally flooded (IIw):

Comfrey silty clay loam.
Dorchester loam and silt loam.
Dorchester silty clay loam.
Alluvial land, 0 to 2 percent slopes.
Alluvial land, 2 to 6 percent slopes.

These bottom-land soils range from well drained to somewhat poorly drained. Most of their acreage is cropped. Corn, soybeans, and small grains are grown. Small grains are the least often planted of the three. Spring floods often delay planting. Cover crops should be established in row crops to maintain organic matter and soil structure. Spacing of crop rows 60 inches apart will make it easier to establish the cover crop. Return all crop residues to the soils and apply lime and fertilizer, including nitrogen, according to soil tests and need of the crop. Mechanical methods of conserving the soils are not needed. Dikes may be practical in places to promote protection from minor floods. Wooded areas can be improved by planting cottonwoods.

MANAGEMENT GROUP 7

Deep dark silty soils (IIIe):

Clarion silt loam, 6 to 12 percent slopes.
Clarion silt loam, 6 to 12 percent slopes, moderately eroded.
Lester silt loam, 6 to 12 percent slopes.
Lester silt loam, 6 to 12 percent slopes, moderately eroded.
Terril silt loam, 6 to 12 percent slopes.

These well-drained, moderately permeable silt loams need a good crop rotation and stripcropping or terracing to control erosion and preserve productivity and tilth. If stripcropping is used, the soils should be in meadow at least half of the time, and the strips of meadow ought to alternate with a row crop or a small grain (fig. 9). Terracing calls for meadow at least 1 year out of every 4, and crop residues should be returned to the soil.

Contour tillage or across-the-slope tillage should be used where stripcropping or terracing is not practicable, for example, on short or irregular complex slopes. If contour tillage or across-the-slope tillage is used, the soils need to be in hay or pasture at least half the time and crop residues are returned to the soils. Plow planting of row crops is also suggested for land not terraced or stripcropped. Lime and fertilizer ought to be applied with all the crop rotations in amounts shown necessary by soil tests.

***Figure 9.*—Lester soils showing eroded spots. Mostly capability class III.**

MANAGEMENT GROUP 8

Deep light-colored loamy soils (IIIe):

Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes.
Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes, moderately eroded.
Hayden loam, 6 to 12 percent slopes.
Hayden loam, 6 to 12 percent slopes, moderately eroded.
Hayden sandy loam, 6 to 12 percent slopes.
Hayden sandy loam, 6 to 12 percent slopes, moderately eroded.
Terril sandy loam, 6 to 12 percent slopes.

In this group are well-drained, moderately permeable loams and sandy loams of the uplands. The areas that are not eroded are mostly in woodland, pastured woodland, or permanent pasture. Eroded areas are in crops and range from fair to good as cropland. Rotations now used—1 or 2 years of meadow out of 6 or 7—allow too much erosion and loss of fertility. If stripcropping is used, and alternate strips are in hay (fig. 10), a rotation that keeps the soils in meadow half the time is suitable. If terracing is

***Figure 10.*—Contour stripcropping, with alternate strips in hay and grain. Grassed waterway in foreground. Capability class III.**

practiced, a rotation made up of 2 years of corn, 1 year of small grain, and 1 year of meadow is good. Short or irregular slopes are not suitable for stripcropping or terracing, and the rotation must be one that keeps hay or pasture on the soils at least 3 years out of 5.

Manure, if available, should be applied to the eroded areas first, then to less eroded areas until the supply is exhausted. Lime and fertilizer should be applied according to needs shown by soil tests.

Permanent pasture on soils of this group can be improved by following the suggestions in the subsection providing general management for pasture.

Wooded areas on soils of this group consist mainly of oak but include hard maple, red and American elm, black cherry, basswood, and white ash. The species to be encouraged are white oak, hard maple, red elm, basswood, and white ash. Open areas can be planted to white pine.

MANAGEMENT GROUP 9

Dark soils moderately deep to sand or gravel (IIIe):

Dakota loam, 6 to 12 percent slopes, moderately eroded.
Lakeville loam, 6 to 12 percent slopes.
Lakeville loam, 6 to 12 percent slopes, moderately eroded.
Waukegan silt loam, 6 to 12 percent slopes, slightly and moderately eroded.

In this management group are moderately permeable, well drained to somewhat excessively drained loams and silt loams of the uplands and terraces. If contour or across-the-slope farming is practiced, the best rotation consists of 1 year of corn, 1 year of a small grain, and 3 years of alfalfa-bromegrass meadow. For stripcropping, 1 year of corn, 1 year of a small grain, and 2 years of alfalfa-bromegrass meadow is good. Alternate strips should be in meadow. For terracing, 2 years of corn, 1 year of a small grain, and 1 year of legume-grass meadow can be used. Lime and fertilizer should be applied for all the crop rotations in accordance with soil tests.

Care should be taken to prevent gullies from forming in these soils. The moderate depth of good soil over sand and gravel makes gullies difficult to control once they have started.

The pastures on these soils cannot be relied on to produce all the forage needed; consequently, supplemental pastures must be used.

Wooded areas can be improved by planting the open spaces and by underplanting the partially shaded areas with white pine, red pine, and to minor extent, white spruce. Odd corners and old gravel pits and surrounding areas can be developed as wildlife areas by planting trees, shrubs, grasses, and legumes for food and cover.

MANAGEMENT GROUP 10

Dark soils moderately shallow to bedrock (IIIe):

Copas silt loam, 0 to 2 percent slopes.
Copas silt loam, 2 to 6 percent slopes.
Copas silt loam, 2 to 6 percent slopes, moderately eroded.

The soils of this group are moderately permeable, well-drained silt loams on the limestone and sandstone benches. For the nearly level areas (0 to 2 percent slopes) a rotation consisting of 2 years of corn or soybeans, 1 year of a small grain, and 1 year of legume-grass meadow is suitable, provided all crop residues are returned to the soil and lime, phosphate, potash, and nitrogen are applied. With stripcropping, the areas on slopes of 2 to 6 percent need a rotation made up of 1 year of corn, 1 year of a small grain, and 2 years of alfalfa-bromegrass meadow. If the slopes of 2 to 6 percent are not stripcropped, a 5-year rotation that provides 1 year of corn, 1 year of small grain, and 3 years of alfalfa-bromegrass meadow is suggested. Because the soils of this group are shallow, terracing should not be attempted. The soils of this group include a very small acreage on slopes of 6 to 12 percent that should be planted to a row crop no more than 1 year in 6.

Areas with many boulders, outcrops, or shallow spots have been left in permanent pasture, which cannot be renovated because of these obstacles. Management consists of applying nitrogen or a complete fertilizer and rotating the grazing. Weeds and woody or brushy growth can be controlled by sprays.

MANAGEMENT GROUP 11

Moderately fine textured nearly level soils (IIIw):

Blue Earth silty clay loam, 0 to 3 percent slopes.
Glencoe silty clay loam.
Webster-Glencoe silty clay loams.

This group consists of dark-colored, deep, moderately slowly permeable, poorly to very poorly drained clay loam and silty clay loam soils. They are nearly level soils of the uplands. Drainage is necessary if these soils are to be used for tilled crops (fig. 11). Before drainage, they are ordinarily in permanent pasture, though they may have been cropped occasionally in dry years.

Tile drainage is most suitable, provided outlets for the tile lines are available. Where large quantities of water must be handled, however, open-ditch drainage is advisable.

After drainage has been installed, a crop rotation that includes grass-legume mixtures should be used. Preferably, the legumes should be deep-rooted, as an important reason for growing legume-grass mixtures is to improve the structure and tilth of the soils so that the tile lines will work effectively. A good growth

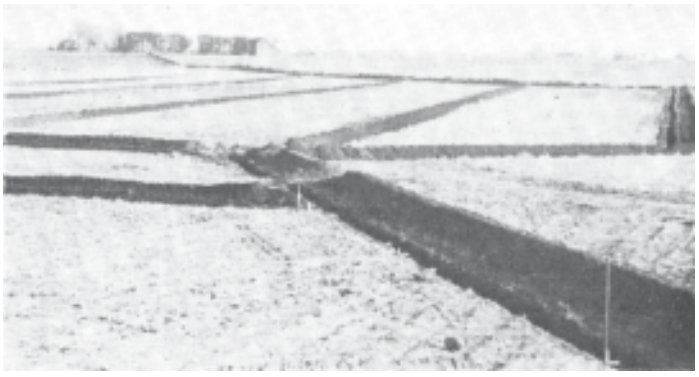

Figure 11.—Tile trenches in Glencoe silty clay loam. Capability class III.

of grass and legumes should be plowed down from time to time, and all crop residues and manure ought to be returned to the soils. The structure of these soils will be damaged if they are worked when wet.

Blue Earth silty clay loam benefits from heavy applications of potash fertilizer, extra amounts of organic matter, and adequate drainage. These practices, applied together, are needed to lessen the undesirable effects of the large amounts of lime this soil contains. Blue Earth silty clay loam has many shell fragments on the surface and throughout the profile.

If soils of the group are drained, a rotation made up of 4 years of corn or soybeans, 1 year of small grain, and 1 year of legume-grass meadow can be used, provided all crop residues are returned to the soil and fertilizer is applied according to soil tests.

If these soils are not drained, pastures can be improved by plowing them early in fall when they are dry enough to work. It is best to seed the grasses in fall and to broadcast suitable legumes over the area in spring. Pasturing should be deferred until the ground is firm. Where drainage ditches are used in pastures, the ditchbanks can be seeded to grasses and legumes that will furnish food and cover for wildlife. To protect young birds and animals, grazing or mowing of the ditchbanks ought to be delayed until after the time the small grains are harvested. The ditchbanks should not be burned over. Level ditches (see fig. 12) and ponds can be made for wildlife.

MANAGEMENT GROUP 12

Moderately coarse textured nearly level soils (IIIw):

Duelm fine sandy loam, 0 to 3 percent slopes.
Isanti fine sandy loam.

In this group are moderately dark to dark, deep, moderately rapidly permeable, somewhat poorly to very poorly drained soils of the terraces. The better drained areas are ordinarily cropped with the surrounding soils. The crops grown are corn, soybeans, small grains, and hay.

The rotation ordinarily used on these soils is that used on the soils surrounding them. Where it is practical to select a rotation suitable for these soils, one made up of 2 years of corn, 1 year of small grain, and 2 years of legume-grass meadow is suggested. These soils can be drained by open ditches. The areas of these soils are small and scattered and are surrounded by Zimmerman and Hubbard soils, which are droughty and subject to severe wind erosion if used as cropland.

Much of the acreage in management group 12 is pastured. Some of the pastures could be improved by working them in dry seasons and seeding to reed canarygrass or similar grasses tolerant of retarded drainage. Phosphate and potash should be applied to these pastures in accordance with soil tests.

MANAGEMENT GROUP 13

Organic soils (IIIw):

Beach materials and Muck.
Peat, deep, 0 to 2 percent slopes.
Peat, deep, 2 to 6 percent slopes.
Peat and Muck, shallow, 0 to 2 percent slopes.
Peat and Muck, shallow, 2 to 12 percent slopes.

***Figure 12.*—Drainage ditch in deep Peat; spoil banks have been leveled. Capability class III.**

Unless the soils of this group are adequately drained (fig. 12), they are used for pasture or wild hay, or in some areas are left as a habitat for wildlife. Areas that have been drained are used for silage corn, sweet corn, soybeans, flax, small grains, and mixed hay.

Drainage of these organic soils is suggested only if enough water can be removed to make them suitable for cropland. On the deep peats, the main outlets generally will need to be open ditches. The volume of water to be removed is normally so large that outlets of tile would be too expensive. Lateral lines leading to the ditches ordinarily are tile. The lateral tile lines must be placed at least 4 feet deep to compensate for settling and shrinkage that will take place when the peats are drained.

The shallow peats and mucks tend to decompose rapidly under cultivation. The tile lines therefore ought to be installed deep enough to be effective after the soils have settled 18 to 24 inches.

Drainage systems on the soils of this group should provide controls that can be used to prevent them from getting too dry. Dry organic soils can be destroyed or seriously damaged by fire.

After organic soils have been drained, it is helpful to apply manure immediately. The manure promotes decay of the organic matter to a form crops can use more readily. The organic soils normally are low in phosphorus and potassium, so heavy applications of phosphate and potash fertilizer are suggested. The soils tend to warm up slowly in spring, so a starter fertilizer containing nitrogen is advocated to get crops off to a good start. Short-season crops are suggested because organic soils are more subject to frost than those on higher ground. Frosts late in summer may catch long-season crops before they are mature.

Undrained or inadequately drained areas of these soils can be pastured. To improve the pastures, work the soils thoroughly during a dry season, fertilize, and seed reed canarygrass. A topdressing of fertilizer will

improve the quality and palatability of the grass. When well established, reed canarygrass forms a tough, dense sod. It will support light haying equipment or grazing cattle, even when the soils are partly wet. Canarygrass produces better and more palatable hay than the wild marshgrasses.

Consideration should be given to developing undrained areas for wildlife. These areas can be improved by level ditching or by installing structures that will control the level of water. Marshy areas thus formed provide an excellent habitat for waterfowl and muskrats. Trapping and sale of hunting rights can provide an additional source of income.

MANAGEMENT GROUP 14

Dark soils moderately shallow to sand or gravel (IIIs):

Dakota sandy loam, 0 to 2 percent slopes.
Dakota sandy loam, 2 to 6 percent slopes.
Dakota sandy loam, 2 to 6 percent slopes, moderately eroded.
Estherville loam and sandy loam, 0 to 2 percent slopes.
Estherville loam and sandy loam, 2 to 6 percent slopes.
Estherville loam and sandy loam, 2 to 6 percent slopes, moderately eroded.

In this management group are moderately rapidly permeable, somewhat excessively to excessively drained sandy loams and loams of the terraces. Much of their acreage is nearly level, and most of this is cultivated. On the nearly level areas, it is suggested that wind stripcropping be used with a 4-year rotation consisting of at least 1 year of meadow and not more than 2 years of row crops. Legumes should be seeded with small grains; they will provide hay and, when plowed under, will produce organic matter to reduce the danger of drought and wind erosion and to help to maintain fertility.

On the soils with slopes of 2 to 6 percent, contour stripcropping is the most effective way of controlling wind and water erosion. A suitable rotation to combine with contour stripcropping is 1 year of corn, 1 year of small grain, and 2 years of meadow. The meadow is planted in alternate strips.

If contour stripcropping is not practical on slopes of 2 to 6 percent, wind stripcropping can be used with the rotation already suggested for the nearly level soils of this management group. Plowing should be done in spring. The stubble or grass is needed on the soil to control wind erosion during winter.

Terraces are not needed on these soils if suggested cropping systems are used. Some long slopes, however, need diversion ditches. Areas in which water concentrates should be grassed to prevent gullying.

Because these soils are droughty, it is better to pasture the second year of meadow in the rotation than it is to attempt to maintain permanent pasture. Lime and fertilizer are needed in amounts shown by soil tests.

Little of this group of soils is wooded, but the soils are especially suitable for evergreens. White and red pine are suggested for planting. Scotch pine is desirable for Christmas trees, but jack pine should be avoided. Plant early in spring and use transplant stock rather than seedlings.

Gravel pits and odd corners can be improved for wildlife by planting trees, shrubs, legumes, and grasses that will provide food and cover.

Figure 13.—**Overgrazed pasture on morainic topography; small pond in background.**

MANAGEMENT GROUP 15

Deep silty and loamy soils (IVe):

Burnsville, Hayden, Kingsley, and Scandia loams, 12 to 18 percent slopes.
Burnsville, Hayden, Kingsley, and Scandia loams, 12 to 18 percent slopes, moderately eroded.
Clarion soils, 6 to 12 percent slopes, severely eroded.
Hayden soils, 6 to 12 percent slopes, severely eroded.
Hayden loam, 12 to 18 percent slopes.
Hayden loam, 12 to 18 percent slopes, moderately eroded.
Hayden sandy loam, 12 to 18 percent slopes.
Hayden sandy loam, 12 to 18 percent slopes, moderately eroded.
Lester soils, 6 to 12 percent slopes, severely eroded.
Lester silt loam, 12 to 18 percent slopes.
Lester silt loam, 12 to 18 percent slopes, moderately eroded.
Terril silt loam, 12 to 18 percent slopes.
Terril sandy loam, 12 to 18 percent slopes.

The soils of this group are light to dark colored, moderately permeable, and well drained. The soils that have had little or no erosion are mostly in woods or permanent pasture (fig. 13). It is suggested that they be kept under this cover and that they be managed as described in the subsection, General Management for Pasture, Woodland, and Wildlife Areas.

The eroded soils of this group are largely those used as cropland (fig. 14). Past management has increased erosion, but on the eroded hilly soils, alfalfa is gradually replacing corn in the cropping system.

If contour stripcropping is practiced, the cleared soils of this management group can be used in a rotation made up of 1 year of corn, 1 year of small grain, and 3 or 4 years of alfalfa-bromegrass meadow. If contour farming is used, a rotation consisting of 1 year of small grain and 2 or 3 years of meadow is satisfactory. Areas on slopes of 12 to 18 percent are not suitable for terracing.

The soils of this group on complex and irregular slopes are not suitable for row crops. It is normally not practical to use contouring or contour stripcropping on them, so row crops should not be planted. For these soils, a rotation made up of 1 year of small grain and 3 years of meadow is appropriate, provided the farming is done across the slope. Actually it is better to keep these soils in legumes and grasses.

All the soils of this management group need lime and fertilizer in amounts shown necessary by soil tests.

Figure 14.—**On ridges, Hayden soils so eroded that the subsoil and parent material are exposed (capability class IV). In depressions, Glencoe soil of management group 11 (capability class III).**

Where hay or rotation pasture remains more than 2 years, it may be necessary to maintain yields by applying phosphate and potash fertilizer after the first cutting in the second year. Manure can be substituted for the fertilizer, or both manure and phosphate-potash fertilizer can be applied.

MANAGEMENT GROUP 16

Loamy and silty soils moderately deep to sand or gravel (IVe):

Lakeville loam, 12 to 18 percent slopes.
Lakeville loam, 12 to 18 percent slopes, moderately eroded.
Waukegan silt loam, 12 to 18 percent slopes, moderately eroded.

In this group are dark-colored, moderately permeable, well drained to somewhat excessively drained loams and silt loams of the uplands and terraces. They are suited to only limited cultivation. Areas in pasture or woods should not be cleared. The cultivated areas ought to be kept in meadow as much of the time as possible. On uniform slopes where stripcropping is used, a rotation made up of 1 year of corn, 1 year of small grain, and 4 years of alfalfa-bromegrass meadow is suggested. Stripcropping is impractical in areas where slopes are short and irregular, so these soils should not be used for row crops. These irregular areas can be farmed across the slope and kept in meadow or pasture 3 years out of 4.

Hay stands remaining longer than 2 years will produce better if a topdressing of manure or phosphate-potash fertilizer is applied after the first cutting in the second year. Pastures should not be overgrazed. Where possible, they should be renovated and reseeded to grasses and legumes every few years. Lime and fertilizer are needed at the time of reseeding. The amount of lime and fertilizer to apply to pasture meadow, and tilled crops can be determined by taking soil tests.

Wooded areas on these soils can be maintained and improved by using the management suggested in the subsection, General Management for Pasture, Woodland, and Wildlife Areas. Open areas can be planted, and the thinly shaded areas interplanted, with white or red pine, or to minor extent, white spruce.

Odd corners and gravel pits on soils of this management group can be developed as wildlife areas by planting suitable trees, shrubs, legumes, and grasses for food and cover.

MANAGEMENT GROUP 17

Sloping excessively drained loamy soils (IVs):

Dakota sandy loam, 6 to 12 percent slopes, moderately eroded.
Estherville loam and sandy loam, 6 to 12 percent slopes.
Estherville loam and sandy loam, 6 to 12 percent slopes, moderately eroded.

The soils of this group are dark colored, shallow to moderately shallow to sand and gravel, and moderately rapidly permeable. They are well-drained to excessively drained soils of the terraces.

Suitable for these soils is contour stripcropping combined with a 4-year rotation made up of 1 year of corn, 1 year of small grain, and 2 years of alfalfa-bromegrass meadow. If stripcropping is not feasible, contour or across-the-slope tillage can be substituted and the same 4-year rotation used. Green manure and crop residues should be plowed under in spring. If they are plowed down in fall, the soil is exposed to wind erosion during winter. Plow planting of row crops is advisable as a supplement to other erosion control practices.

These excessively drained soils are not suitable for permanent pasture. It is better to use them in a crop rotation and to pasture the second year of meadow. Ordinarily, the meadow will not provide enough pasture in dry seasons; supplemental pasture or feeding will be necessary.

These soils are suitable sites for growing Scotch pine to be used for Christmas trees. Planting is best done early in spring, and it is advisable to use transplant stock rather than seedlings. White and red pine are suitable for planting on these soils.

Gravel pits and odd corners on soils of this group can be improved for wildlife by planting trees, shrubs, legumes, and grasses that will provide food and cover.

MANAGEMENT GROUP 18

Nearly level to gently sloping sandy soils (IVs):

Hubbard loamy fine sand, 0 to 2 percent slopes.
Hubbard loamy fine sand, 2 to 6 percent slopes.
Hubbard loamy fine sand, 2 to 6 percent slopes, moderately wind eroded.

These soils of the terraces are moderately dark colored, deep, and droughty fine sands with a medium-textured layer at depths of 3 feet or more. At present no rotation is systematically followed. When moisture is normal or above, and well distributed throughout the growing season, fair yields of corn, oats, soybeans, winter grains, and hay are obtained.

The main problems on these soils are wind erosion and droughtiness. They need a cropping system that will provide year-round ground cover. Wind stripcropping, stubble-mulch tillage, and spring plowing will help to control wind erosion. These practices can

be supplemented by planting shelterbelts of pine at intervals of 40 rods. All available manure and crop residues should be returned to the soils, as they help to control wind erosion and to improve the moisture-holding capacity of the soils. It is advisable to plow down a good growth of legumes at regular intervals.

Wind stripcropping is advised for the areas on slopes of 0 to 2 percent. A suitable rotation to be used with wind stripcropping is 2 years of corn, 1 year of small grain, and 2 years of legume-grass meadow. If contour stripcropping is used on slopes of 2 to 6 percent, a suitable rotation is 1 year of corn, 1 year of small grain, and 2 years of meadow. All crops will benefit from lime and fertilizer in years when moisture is normal or better, and the legumes especially need these amendments. These soils can be used for truck crops if they are irrigated and receive heavier applications of a complete fertilizer and large amounts of green manure or crop residues.

The soils of this group are suitable for growing evergreens. White and Norway pine are most suitable. Scotch pine of northern origin can be planted for Christmas trees. Planting is best done early in spring; transplant stock rather than seedlings should be used.

These soils are not suitable for permanent pasture; it is too difficult to maintain a good sod.

MANAGEMENT GROUP 19

Sloping sandy soils (IVs):

Hubbard loamy fine sand, 6 to 12 percent slopes.
Hubbard loamy fine sand, 6 to 12 percent slopes, moderately eroded.

In this group are moderately dark colored, deep, droughty fine sands of the terraces. They have a medium-textured layer at a depth of 3 feet or more.

Suitable for these soils is contour stripcropping combined with a rotation made up of 1 year of corn, 1 year of small grain, and 2 years of alfalfa-bromegrass meadow. This rotation will control erosion. A top-dressing of complete fertilizer, manure, or both, will be needed to maintain the meadow. All the crops will benefit from lime and fertilizer, but they are especially needed by the legumes. The amounts needed can be determined by soil tests.

If contour stripcropping or contour farming is not practical, a rotation consisting of 1 year of corn, 1 year of small grain, and 3 years of legume-grass meadow can be used with good results. It is not advisable to terrace these soils.

The dominant problems of management on these soils are wind erosion and droughtiness. Shelterbelts of pine spaced 40 rods apart will help protect the soils against wind erosion. Stubble-mulch tillage and spring plowing ought to be practiced.

These soils are well suited to evergreens. White and red pines thrive best. It is advisable to plant early in spring and to use transplant stock rather than seedlings. Scotch pine of northern origin can be planted for Christmas trees.

These soils are not suitable for permanent pasture; a good sod is too difficult to maintain.

MANAGEMENT GROUP 20

Nearly level to gently sloping gravelly soils (IVs):

Estherville gravelly sandy loam, 0 to 6 percent slopes.
Estherville gravelly sandy loam, 0 to 6 percent slopes, moderately eroded.
Lakeville-Burnsville gravelly sandy loams, 0 to 6 percent slopes.
Lakeville-Burnsville gravelly sandy loams, 0 to 6 percent slopes, moderately eroded.

These soils of the uplands and terraces are dark colored, shallow to gravel, moderately coarse textured, and droughty.

Corn, soybeans, and rye or winter wheat are grown on the Estherville soils of this group, but not in any systematic sequence. A rotation is difficult to establish because it is hard to get a satisfactory stand of legumes. A rotation made up of 1 year of row crop, 1 year of small grain, and 1 year of meadow can be used, but the low yields hardly justify cropping this land. If wind stripcropping is practiced, a rotation consisting of 2 years of corn, 1 year of small grain, and 1 year of meadow can be used. For contour stripcropping on slopes of 2 to 6 percent, a suitable rotation is 1 year of a row crop, 1 year of a small grain, and 2 years of meadow. Any cropping system used on these soils should provide year-round cover, and wind stripcropping is advisable. The soils are droughty and erodible, so the more organic matter that can be added the better.

The Lakeville-Burnsville soils of this management group are frequently left in permanent pasture. It is difficult to establish and maintain a good sod on soils so low in fertility and in moisture-holding capacity. Many areas of these soils occur as knolls within tracts of Clarion, Lester, or Hayden soils and are farmed with them. The rotation that can be used for the Lakeville-Burnsville soils is 1 year of a row crop, 1 year of small grain, and 2 years of alfalfa-bromegrass meadow.

Jack and Norway pine can be used for planting where shelterbelts are needed or in areas to be used as woodland. It is best to plant early in spring and to use transplant stock rather than seedlings.

These soils contain many gravel pits that can be developed for wildlife by planting trees, shrubs, grasses, and legumes that will provide food and cover.

MANAGEMENT GROUP 21

Hummocky soil that is shallow to bedrock and contains many boulders (Vw):

Only one soil is in this group, Faxon silty clay loam, 0 to 6 percent slopes. It is a dark-colored, poorly drained soil of the terraces. All of it is in pasture, but many large boulders and hummocks prevent renovation and reseeding. Nevertheless, the pasture can be improved by applying nitrogen and other fertilizer by hand and by spraying to control weeds and brush. Permanent pasture is the suggested use for this soil.

MANAGEMENT GROUP 22

Light to moderately dark colored loamy or silty soils (VIe):

Burnsville, Hayden, Kingsley, and Scandia soils, 12 to 18 percent slopes, severely eroded.
Burnsville, Hayden, Kingsley, and Scandia loams, 18 to 25 percent slopes, slightly and moderately eroded.
Hayden soils, 12 to 18 percent slopes, severely eroded.
Hayden loam, 18 to 25 percent slopes, slightly and moderately eroded.
Hayden sandy clay loam, 12 to 18 percent slopes, severely eroded.
Hayden sandy loam, 18 to 25 percent slopes, slightly and moderately eroded.
Lester soils, 12 to 18 percent slopes, severely eroded.
Lester silt loam, 18 to 25 percent slopes, slightly and moderately eroded.
Terril sandy loam, 18 to 25 percent slopes.
Terril silt loam, 18 to 25 percent slopes.

In this group are deep, moderately coarse to medium textured, moderately permeable, well-drained soils of the uplands. Strong slopes and erosion have caused farmers to keep much of the acreage in hay or to retire it to permanent pasture (fig. 15). Areas now in permanent pasture or woods should not be cleared. The areas now cropped ought to be retired to pasture, woods, permanent hay meadows, or wildlife habitats.

***Figure 15.*—Complex topography typical of Hayden soils. Capability classes IV and VI.**

Pasture or hay meadows can be renovated and reseeded by digging and disking or otherwise killing the old sod, which must then be left on the surface. The old sod protects the soils against erosion until the new seeding provides cover. Fertilizer and lime are needed in amounts shown by soil tests. Permanent pastures can be improved by first removing stumps and stones. If these are not removed, brush and weeds can be controlled by cutting or spraying, applying nitrogen, and controlling grazing.

Thinly wooded areas can be improved by underplanting with white and Norway pine. White spruce is best for shady areas. Growth of pine may be very slow on the high-lime spots.

Odd areas and deep spots in cultivated fields can be made into wildlife habitats by planting them to shrubs, legumes, and evergreens that will provide food and cover.

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MANAGEMENT GROUP 23

Soils that are frequently flooded (VIw):

Alluvial land, frequent overflow, 0 to 6 percent slopes.
Oshawa silty clay loam.
Rauville silty clay loam.

The soils of this group are poorly drained soils of the bottom lands. Most of their acreage is in pasture, wild hay, or wildlife habitats. Only a small area is cropped. Some hardwood timber grows on the low alluvial land adjoining the river. It could be improved by planting cottonwood trees.

Without adequate drainage and protection from floods, the soils of this management group are limited to the uses mentioned. At present, it probably would be too costly to provide the engineering structures necessary to improve these soils.

MANAGEMENT GROUP 24

Eroded and excessively drained soils (VIIe):

Burnsville, Hayden, Kingsley, and Scandia soils, 18 to 25 percent slopes, severely eroded.
Burnsville, Hayden, Kingsley, and Scandia loams, 25 to 50 percent slopes.
Hayden soils, 18 to 25 percent slopes, severely eroded.
Hayden loam, 25 to 35 percent slopes, slightly and moderately eroded.
Hayden sandy clay loam, 18 to 25 percent slopes, severely eroded.
Hayden sandy loam, 25 to 35 percent slopes, slightly and moderately eroded.
Lester soils, 18 to 25 percent slopes, severely eroded.
Lester silt loam, 25 to 35 percent slopes, slightly and moderately eroded.
Lester soils, 25 to 35 percent slopes, severely eroded.
Steep land, Hayden-Lester materials.

Areas of these soils still in crops should be retired to permanent vegetation. The soils on slopes of 18 to 25 percent can be improved to the point where they will produce fair to good permanent pasture. On soils with slopes of 25 percent or more that have been in crops, it is safest to plant trees. But if a good pasture can be established on these steep soils, limited grazing can be done.

Permanent pasture already established should be managed carefully; this means restricted grazing, control of weeds and brush by cutting or spraying, and the application of nitrogen or a complete fertilizer where slopes are not too steep to interfere with spreading. Areas on slopes of more than 35 percent should not be used for pasture.

It is best to use all of the soils of this group as woodland. All open areas should be planted to trees. Red pine is suited to west and south slopes; white pine is best for east and north slopes. Gravelly and sandy spots on south and west slopes should be planted to jack pine or Norway pine. Patches of gravel and sand on north and east slopes can be planted to white and Norway pine.

MANAGEMENT GROUP 25

Gravelly soils, stony land, and terrace escarpments (VIIs):

Estherville gravelly sandy loam, 6 to 12 percent slopes.
Estherville gravelly sandy loam, 6 to 12 percent slopes, moderately eroded.

Lakeville-Burnsville gravelly sandy loams, 6 to 12 percent slopes.
Lakeville-Burnsville gravelly sandy loams, 6 to 12 percent slopes, moderately eroded.
Lakeville-Burnsville gravelly sandy loams, 12 to 50 percent slopes.
Sandstone outcrops.
Stony land.
Terrace escarpments.

These soils and miscellaneous land types are so droughty they are not suited to crops or pasture. Some areas are cropped occasionally, but most of the acreage is idle. Pasturing will remove what little grass exists on this group of soils. Gullies form quickly on slopes and are difficult to control because of the loose sands and gravel. Stony land and Sandstone outcrops may be used sparingly for pasture.

The soils of this management group, except for the Stony land and the Sandstone outcrops, are well suited to growing pine trees. Jack pine and Norway pine are suitable species. Transplanted stock rather than seedlings should be planted as early in spring as possible. Woodland already existing on these soils should be protected from grazing and fire. Small odd-shaped areas and gravel pits can be improved for wildlife by planting them to evergreen and drought-resistant shrubs.

MANAGEMENT GROUP 26

Deep, droughty sands (VIIs):

Beach materials, sandy.
Dune land.
Hubbard fine sand, 0 to 2 percent slopes.
Hubbard fine sand, 2 to 6 percent slopes.
Hubbard fine sand, 2 to 6 percent slopes, moderately wind eroded.
Hubbard fine sand, 6 to 12 percent slopes.
Hubbard fine sand, 6 to 12 percent slopes, moderately wind eroded.
Zimmerman fine sand, 0 to 2 percent slopes.
Zimmerman fine sand, 0 to 2 percent slopes, moderately wind eroded.
Zimmerman fine sand, 2 to 6 percent slopes.
Zimmerman fine sand, 2 to 6 percent slopes, moderately wind eroded.
Zimmerman fine sand, 6 to 12 percent slopes, slightly and moderately eroded.

Much of the acreage in this group is idle or in poor pasture; some areas have a growth of scrub oak. Corn, oats, winter wheat, rye, and soybeans are still grown, but yields are poor. If cultivation is to continue, wind stripcropping, shelterbelts of pines spaced 40 rods apart, stubble mulch tillage, and irrigation will be necessary. In addition, as much manure and plant residue as possible should be incorporated into the soils.

These soils are not suitable for permanent pasture; it is too difficult to maintain a good sod. With irrigation, plowing under of green-manure crops, and large applications of complete fertilizer, early vegetables or nursery crops can be grown.

Where not irrigated, these soils are best used to grow pines. Suitable species are jack pine and Norway pine. Scotch pine of northern origin can be planted for Christmas trees. Transplanted stock rather than seedlings should be planted as early in spring as possible.

Trees are difficult to establish on the severely wind eroded areas (Dune land), and it is suggested that these areas be spread with straw and lightly disked before planting. The most suitable species are the same as those already mentioned for the uneroded and moderately eroded soils.

MANAGEMENT GROUP 27

Marsh (VIII):

Marsh areas are best suited to wildlife. Waterfowl, muskrats, and upland game find food, cover, and nesting places in and around this type of land. Marsh areas may be improved by level ditching or water-level controls.

Among the commercial uses of Marsh are trapping of muskrats and sale of hunting rights.

Estimated Yields

Estimated average acre yields of principal crops are listed for the soils of Scott County in table 3. In columns A are yields to be expected under average management, and in columns B are yields to be expected under the improved management that some farmers in the county are now practicing.

The yields are estimated averages for a 5- to 10-year period. They do not take into account abnormal crop seasons or the past management of a soil on a particular farm. The yields are based on interviews with farmers, members of the staff of the Minnesota Agricultural Experiment Station, and others familiar with the agriculture of the county. Considered in making the estimates were the prevailing climate, characteristics of the soils, and the influence of different kinds of management on the soils.

The management needed to get the yields in columns A consists of applying all available manure and the equivalent of 100 to 150 pounds of 4-24-12 starter fertilizer to corn; little or no fertilizer is applied to small grains or hay meadows. The rotations are variable. Frequently corn alternates with oats, and sometimes soybeans alternate with oats. A legume meadow is grown once in 6 to 8 years.

The management required to obtain the yields in columns B is essentially that described in the subsection, Management Groups, which provides a table of suitable crop rotations and supporting practices. Under this management, manure, lime, starter fertilizer, and a side dressing of nitrogen are applied for corn, and phosphate and potash are applied to small grains. The amounts of lime and fertilizer needed are determined by soil tests.

TABLE 3.—*Estimated average acre yields of principal crops under two levels of management*

[In columns A are yields expected under average management, and in columns B, yields under improved management; dashed lines indicate crop ordinarily is not grown and soil is not suitable for its production]

Soil	Corn		Corn silage		Oats		Soybeans		Alfalfa or alfalfa-bromegrass		Rotation pasture		Forest yields	Management group[1]
	A	B	A	B	A	B	A	B	A	B	A	B		
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days*[2]	*Cow-acre-days*[2]	*Bd. feet*[3]	
Alluvial land, 0 to 2 percent slopes[4]	50	65	10	12	40	45	20	25					300	6
Alluvial land, 2 to 6 percent slopes[4]	45	60	9	12	35	40	18	23					300	6
Alluvial land, frequent overflow, 0 to 6 percent slopes													300	23
Beach materials, sandy														26
Beach materials and Muck	40	45	13	15	35	40	20	25			90	100		13
Blue Earth silty clay loam, 0 to 3 percent slopes[6]	50	60	11	13	40	45	20	25			125	150		11
Burnsville, Hayden, Kingsley, and Scandia loams, 0 to 6 percent slopes	45	55	9	11	35	40	12	15	2.5	2.7	125	140	200	3
Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes	40	50	8	10	30	35	10	12	2.2	2.5	115	125	200	8
Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes, moderately eroded	35	45	7	9	25	30	9	11	2.0	2.2	100	115	(5)	8
Burnsville, Hayden, Kingsley, and Scandia loams, 12 to 18 percent slopes	30	40	6	8	25	30	9	11	2.0	2.2	100	115	160	15
Burnsville, Hayden, Kingsley, and Scandia loams, 12 to 18 percent slopes, moderately eroded	25	35	5	7	20	25	8	10	1.7	2.0	90	100	(5)	15
Burnsville, Hayden, Kingsley, and Scandia soils, 12 to 18 percent slopes, severely eroded	20	30	4	6	15	20			1.5	1.7	75	90	(5)	22
Burnsville, Hayden, Kingsley, and Scandia loams, 18 to 25 percent slopes, slightly and moderately eroded					20	25			1.2	1.5	65	75	100	22
Burnsville, Hayden, Kingsley, and Scandia soils, 18 to 25 percent slopes, severely eroded					15	20			1.0	1.2	50	65	(5)	24
Burnsville, Hayden, Kingsley, and Scandia loams, 25 to 50 percent slopes									1.0	1.2	50	65	70	24
Clarion silt loam, 2 to 6 percent slopes	70	85	13	15	55	65	30	35	3.5	4.0	175	200	(5)	2
Clarion silt loam, 2 to 6 percent slopes, moderately eroded	65	80	12	14	50	60	28	33	3.2	3.7	165	190	(5)	2
Clarion silt loam, 6 to 12 percent slopes	65	80	12	14	50	60	25	30	3.0	3.5	150	175	(5)	7
Clarion silt loam, 6 to 12 percent slopes, moderately eroded	60	75	12	14	45	55	22	26	2.7	3.0	140	150	(5)	7
Clarion soils, 6 to 12 percent slopes, severely eroded	50	65	10	12	35	50	15	20	2.0	2.5	100	125	(5)	15
Comfrey silty clay loam[4]	50	65	10	12	45	50	26	30	2.0	2.5	100	125	(5)	6
Copas silt loam, 0 to 2 percent slopes	35	40	7	8	35	40	12	15	1.5	1.7	75	90	(5)	10
Copas silt loam, 2 to 6 percent slopes	30	35	6	7	30	40	10	13	1.5	1.7	75	90	(5)	10
Copas silt loam, 2 to 6 percent slopes, moderately eroded	25	30	5	6	25	35	9	12	1.2	1.5	65	75	(5)	10
Dakota loam, 0 to 2 percent slopes	45	55	9	11	45	55	14	18	2.0	2.2	100	115	(5)	4
Dakota loam, 2 to 6 percent slopes	40	50	8	10	40	50	12	16	2.0	2.2	100	115	(5)	4
Dakota loam, 2 to 6 percent slopes, moderately eroded	35	45	7	9	35	45	11	15	1.7	2.0	90	100	(5)	4
Dakota loam, 6 to 12 percent slopes, moderately eroded	25	35	5	7	30	40	9	13	1.7	2.0	90	100	(5)	9
Dakota sandy loam, 0 to 2 percent slopes	40	45	8	9	35	45	11	14	1.5	1.7	75	90	(5)	14

See footnotes at end of table.

TABLE 3.—*Estimated average acre yields of principal crops under two levels of management*—Continued

Soil	Corn		Corn silage		Oats		Soybeans		Alfalfa or alfalfa-bromegrass		Rotation pasture		Forest yields	Management group
	A	B	A	B	A	B	A	B	A	B	A	B		
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acres days*[2]	*Cow-acre-days*[2]	*Bd. feet*[3]	
Dakota sandy loam, 2 to 6 percent slopes	35	40	7	8	30	40	10	13	1.5	1.7	75	90	(5)	14
Dakota sandy loam, 2 to 6 percent slopes, moderately eroded	30	35	6	7	25	35	9	11	1.5	1.7	75	90	(5)	14
Dakota sandy loam, 6 to 12 percent slopes, moderately eroded	25	30	5	6	20	30	8	10	1.2	1.5	65	75	(5)	17
Dorchester silty clay loam[4]	50	65	10	12	40	45	25	30	2.0	2.5	100	125	300	6
Dorchester loam and silt loam[4]	50	65	10	12	40	45	25	30	2.0	2.5	100	125	300	6
Duelm fine sandy loam, 0 to 3 percent slopes	40	50	8	10	30	35	15	20	1.7	2.0	90	100	------	12
Dundas silt loam, 0 to 2 percent slopes	55	65	11	12	45	55	20	25	3.0	3.5	150	175	100	5
Dune land	------	------	------	------	------	------	------	------	------	------	------	------	------	26
Estherville gravelly sandy loam, 0 to 6 percent slopes	------	------	------	------	20	25	4	5	------	------	------	------	(5)	20
Estherville gravelly sandy loam, 0 to 6 percent slopes, moderately eroded	------	------	------	------	18	23	4	5	------	------	------	------	(5)	20
Estherville gravelly sandy loam, 6 to 12 percent slopes	------	------	------	------	18	23	3	4	------	------	------	------	(5)	25
Estherville gravelly sandy loam, 6 to 12 percent slopes, moderately eroded	------	------	------	------	15	20	3	4	------	------	------	------	(5)	25
Estherville loam and sandy loam, 0 to 2 percent slopes	25	35	5	7	25	30	6	7	1.5	1.7	75	90	(5)	14
Estherville loam and sandy loam, 2 to 6 percent slopes	20	30	4	6	22	28	5	6	1.5	1.7	75	90	(5)	14
Estherville loam and sandy loam, 2 to 6 percent slopes, moderately eroded	18	28	4	6	20	25	4	5	1.5	1.7	75	90	(5)	14
Estherville loam and sandy loam, 6 to 12 percent slopes	15	25	3	5	20	25	4	5	1.2	1.5	65	75	(5)	17
Estherville loam and sandy loam, 6 to 12 percent slopes, moderately eroded	12	23	3	5	18	23	3	4	1.0	1.2	50	65	(5)	17
Faxon silty clay loam, 0 to 6 percent slopes	------	------	------	------	------	------	------	------	------	------	------	------	------	21
Glencoe silty clay loam[6]	60	75	12	14	50	60	30	35	------	------	140	150	------	11
Hayden loam, 0 to 6 percent slopes	60	70	12	13	45	55	25	30	3.0	3.5	150	175	260	3
Hayden loam, 2 to 6 percent slopes, moderately eroded	55	65	11	12	40	50	20	25	2.7	3.2	140	165	(5)	3
Hayden loam, 6 to 12 percent slopes	55	65	11	12	40	50	20	25	2.5	3.0	125	150	260	8
Hayden loam, 6 to 12 percent slopes, moderately eroded	50	60	10	12	35	50	15	20	2.2	2.7	115	140	(5)	8
Hayden loam, 12 to 18 percent slopes	45	55	9	11	35	50	12	15	1.7	2.2	90	115	210	15
Hayden loam, 12 to 18 percent slopes, moderately eroded	40	50	8	10	30	45	10	12	1.5	2.0	75	100	(5)	15
Hayden loam, 18 to 25 percent slopes, slightly and moderately eroded	------	------	------	------	25	40	------	------	1.2	1.7	65	90	160	22
Hayden loam, 25 to 35 percent slopes, slightly and moderately eroded	------	------	------	------	------	------	------	------	1.0	1.5	50	75	100	24
Hayden soils, 6 to 12 percent slopes, severely eroded	40	50	8	10	25	40	10	15	2.0	2.5	100	125	(5)	15
Hayden soils, 12 to 18 percent slopes, severely eroded	30	40	6	8	20	40	------	------	1.2	1.7	65	90	(5)	22
Hayden soils, 18 to 25 percent slopes, severely eroded	------	------	------	------	10	35	------	------	1.0	1.5	50	75	(5)	24
Hayden sandy loam, 0 to 6 percent slopes	50	60	10	12	40	50	18	23	2.7	3.0	140	150	260	3
Hayden sandy loam, 0 to 6 percent slopes, moderately eroded	45	55	9	11	35	45	16	20	2.5	2.7	125	140	(5)	3

See footnotes at end of table.

TABLE 3.—*Estimated average acre yields of principal crops under two levels of management*—Continued

Soil	Corn		Corn silage		Oats		Soybeans		Alfalfa or alfalfa-bromegrass		Rotation pasture		Forest yields	Management group
	A	B	A	B	A	B	A	B	A	B	A	B		
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acres days*[2]	*Cow-acre-days*[2]	*Bd. feet*[3]	
Hayden sandy loam, 6 to 12 percent slopes	45	55	9	11	35	45	16	20	2.2	2.5	115	125	260	8
Hayden sandy loam, 6 to 12 percent slopes, moderately eroded	40	50	8	10	30	40	14	18	2.0	2.2	100	115	(5)	8
Hayden sandy loam, 12 to 18 percent slopes	40	50	8	10	30	40	10	13	1.7	2.0	90	100	210	15
Hayden sandy loam, 12 to 18 percent slopes, moderately eroded	35	45	7	9	25	35	8	10	1.5	1.7	75	90	(5)	15
Hayden sandy loam, 18 to 25 percent slopes, slightly and moderately eroded									1.2	1.5	65	75	160	22
Hayden sandy loam, 25 to 35 percent slopes, slightly and moderately eroded									1.0	1.2	50	65	70	24
Hayden sandy clay loam, 12 to 18 percent slopes, severely eroded									1.2	1.5	65	75	(5)	22
Hayden sandy clay loam, 18 to 25 percent slopes, severely eroded									1.0	1.2	50	65	(5)	24
Hubbard fine sand, 0 to 2 percent slopes													(5)	26
Hubbard fine sand, 2 to 6 percent slopes													(5)	26
Hubbard fine sand, 2 to 6 percent slopes, moderately wind eroded													(5)	26
Hubbard fine sand, 6 to 12 percent slopes													(5)	26
Hubbard fine sand, 6 to 12 percent slopes, moderately wind eroded													(5)	26
Hubbard loamy fine sand, 0 to 2 percent slopes	25	40	5	8	25	30	6	6	.5	1.0	25	50	(5)	18
Hubbard loamy fine sand, 2 to 6 percent slopes	20	35	4	7	25	30	5	5	.5	1.0	25	50	(5)	18
Hubbard loamy fine sand, 2 to 6 percent slopes, moderately wind eroded	18	33	4	7	20	25	4	4	.5	1.0	25	50	(5)	18
Hubbard loamy fine sand, 6 to 12 percent slopes	12	20	3	4	20	25	4	4	.2	.7	10	40	(5)	19
Hubbard loamy fine sand, 6 to 12 percent slopes, moderately eroded	10	20	2	4	15	20	3	3	.2	.7	10	40	(5)	19
Isanti fine sandy loam[6]	35	50	7	10	30	40	15	20	1.7	2.0	90	100		12
Kasota silt loam, 0 to 2 percent slopes	55	65	11	12	50	60	28	33	2.7	3.2	140	165	(5)	4
Kasota silt loam, 2 to 6 percent slopes	50	60	10	12	45	55	25	30	2.5	3.0	125	150	(5)	4
Lakeville-Burnsville gravelly sandy loams, 0 to 6 percent slopes							8	10	.5	1.0	25	50	45	20
Lakeville-Burnsville gravelly sandy loams, 0 to 6 percent slopes, moderately eroded							7	9	.5	1.0	25	50	(5)	20
Lakeville-Burnsville gravelly sandy loams, 6 to 12 percent slopes							7	9	.5	1.0	25	50	45	25
Lakeville-Burnsville gravelly sandy loams, 6 to 12 percent slopes, moderately eroded							5	6	.2	.7	25	35	(5)	25
Lakeville-Burnsville gravelly sandy loams, 12 to 50 percent slopes													45	25
Lakeville loam, 0 to 2 percent slopes	30	40	6	8	30	35	10	12	1.5	1.7	75	90	(5)	4
Lakeville loam, 2 to 6 percent slopes	25	35	5	7	25	30	8	10	1.5	1.7	75	90	(5)	4
Lakeville loam, 2 to 6 percent slopes, moderately eroded	20	30	4	6	20	25	7	9	1.5	1.7	75	90	(5)	4

See footnotes at end of table.

TABLE 3.—*Estimated average acre yields of principal crops under two levels of management*—Continued

Soil	Corn		Corn silage		Oats		Soybeans		Alfalfa or alfalfa-bromegrass		Rotation pasture		Forest yields	Management group[1]
	A	B	A	B	A	B	A	B	A	B	A	B		
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days*[2]	*Cow-acre-days*[2]	*Bd. feet*[3]	
Lakeville loam, 6 to 12 percent slopes	20	30	4	6	20	25	7	9	1.2	1.5	65	75	(5)	9
Lakeville loam, 6 to 12 percent slopes, moderately eroded	15	30	3	6	15	25	6	7	1.2	1.5	65	75	(5)	9
Lakeville loam, 12 to 18 percent slopes	15	30	3	6	15	25							(5)	16
Lakeville loam, 12 to 18 percent slopes, moderately eroded	15	30	3	6	15	25							(5)	16
Lester silt loam, 2 to 6 percent slopes	65	75	12	14	55	65	30	35	3.5	4.0	175	200	260	2
Lester silt loam, 2 to 6 percent slopes, moderately eroded	60	70	12	13	50	60	28	33	3.2	3.7	165	190	(5)	2
Lester silt loam, 6 to 12 percent slopes	60	70	12	13	50	60	25	30	3.0	3.5	150	175	260	7
Lester silt loam, 6 to 12 percent slopes, moderately eroded	55	65	11	12	45	55	22	26	2.7	3.2	140	165	(5)	7
Lester silt loam, 12 to 18 percent slopes	50	60	10	12	45	60	10	15	2.0	2.5	100	125	210	15
Lester silt loam, 12 to 18 percent slopes, moderately eroded	45	55	9	11	40	55	8	12	1.5	2.0	75	100	(5)	15
Lester silt loam, 18 to 25 percent slopes, slightly and moderately eroded					35	50			1.2	1.7	65	90	160	22
Lester silt loam, 25 to 35 percent slopes, slightly and moderately eroded									.7	1.0	40	50	100	24
Lester soils, 6 to 12 percent slopes, severely eroded	45	55	9	11	35	50	15	20	2.2	2.7	115	140	(5)	15
Lester soils, 12 to 18 percent slopes, severely eroded	35	45	7	9	30	50			1.2	1.7	65	90	(5)	22
Lester soils, 18 to 25 percent slopes, severely eroded					20	45			.7	1.0	40	50	(5)	24
Lester soils, 25 to 35 percent slopes, severely eroded									.7	1.0	40	50	(5)	24
LeSueur silt loam	70	80	13	14	55	65	32	37	3.5	4.0	175	200	260	1
LeSueur-Lester silt loams	70	80	13	14	55	65	32	37	3.5	4.0	175	200	260	1
Marsh														27
Oshawa silty clay loam														23
Peat and Muck, shallow, 0 to 2 percent slopes[6]	45	55	13	14	40	45	20	25			125	140		13
Peat and Muck, shallow, 2 to 12 percent slopes[6]	30	40	10	12	35	40	18	23						13
Peat, deep, 0 to 2 percent slopes[6]	40	50	13	14	35	40	20	25			125	140		13
Peat, deep, 2 to 6 percent slopes[6]	30	40	10	12	30	35	18	23						13
Rauville silty clay loam														23
Sandstone outcrops														25
Steep land, Hayden-Lester materials													75	24
Stony land														25
Terrace escarpments													(5)	25
Terril sandy loam, 0 to 6 percent slopes	50	60	10	12	40	50	18	23	3.0	3.2	150	165	(5)	3
Terril sandy loam, 6 to 12 percent slopes	45	55	9	11	35	45	16	20	2.5	2.7	125	140	(5)	8
Terril sandy loam, 12 to 18 percent slopes	40	50	8	10	30	40	10	13	2.0	2.5	100	125	(5)	15
Terril sandy loam, 18 to 25 percent slopes									1.5	2.0	75	100	(5)	22
Terril silt loam, 0 to 2 percent slopes	70	85	13	15	55	65	32	37	3.5	4.0	175	200	(5)	1
Terril silt loam, 2 to 6 percent slopes	70	85	13	15	55	65	30	35	3.5	4.0	175	200	(5)	2
Terril silt loam, 6 to 12 percent slopes	65	80	12	14	50	60	25	30	3.0	3.5	150	175	(5)	7

See footnotes at end of table.

TABLE 3.—*Estimated average acre yields of principal crops under two levels of management*—Continued

Soil	Corn		Corn silage		Oats		Soybeans		Alfalfa or alfalfa-bromegrass		Rotation pasture		Forest yields	Management group[1]
	A	B	A	B	A	B	A	B	A	B	A	B		
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days*[2]	*Cow-acre-days*[2]	*Bd. feet*[3]	
Terril silt loam, 12 to 18 percent slopes	50	60	10	12	45	55	12	16	2.5	3.0	125	150	([5])	15
Terril silt loam, 18 to 25 percent slopes									2.0	2.5	100	125	([5])	22
Waukegan silt loam, 0 to 2 percent slopes	55	65	11	12	50	60	28	33	2.7	3.2	140	165	([5])	4
Waukegan silt loam, 2 to 6 percent slopes	50	60	10	12	45	55	25	30	2.5	3.0	125	150	([5])	4
Waukegan silt loam, 2 to 6 percent slopes, moderately eroded	45	55	9	11	40	50	22	27	2.2	2.7	115	140	([5])	4
Waukegan silt loam, 6 to 12 percent slopes, slightly and moderately eroded	40	50	8	10	35	45	18	23	2.0	2.5	100	125	([5])	9
Waukegan silt loam, 12 to 18 percent slopes, moderately eroded	30	40	6	8	30	40	10	12	1.7	2.2	90	115	([5])	16
Webster-Glencoe silty clay loams[6]	70	80	13	14	50	60	32	37	3.0	3.2	150	165	([5])	11
Webster-LeSueur silty clay loams[6]	75	85	14	15	50	60	32	37	3.0	3.5	150	175	100	5
Zimmerman fine sand, 0 to 2 percent slopes													([5])	26
Zimmerman fine sand, 0 to 2 percent slopes, moderately wind eroded													([5])	26
Zimmerman fine sand, 2 to 6 percent slopes													([5])	26
Zimmerman fine sand, 2 to 6 percent slopes, moderately wind eroded													([5])	26
Zimmerman fine sand, 6 to 12 percent slopes, slightly and moderately eroded													([5])	26

[1] The management group in which the soil has been placed; see descriptions in text.

[2] Cow-acre-days is the number of days 1 acre will graze 1 cow, steer, or horse without injury to the pasture and without supplemental feeding while the land is pastured.

[3] Annual production in board feet per acre of hardwoods on fully stocked woodland receiving little or no management.

[4] Averages on bottom-land soils are reduced by floods that come about once in 4 or 5 years.

[5] Data not available.

[6] At both levels of management, it is assumed that the soil has been adequately drained.

General Management for Pasture, Woodland, and Wildlife Areas

In this subsection general practices of management are suggested for areas to be used for pasture, trees, and wildlife. The practices suggested do not apply to any particular group of soils; they are basic practices that can be applied to all soils.

PASTURE

Pasture improvement by reseeding:

1. Test the soil to determine need for lime and fertilizer.
2. Apply lime 6 months before seeding.
3. Remove, where feasible, stones, stumps, and other obstructions that interfere with use of farm equipment.
4. Prepare a good seedbed:
   (1) Plow the level to gently sloping soils on the contour.
   (2) Work the steeper slopes so as to leave a mulch on the surface, but do not plow. Start preparing the seedbed several weeks or months before the date of seeding by eradicating weeds through cultivation, spraying, or both.
5. Reseed:
   (1) Use legumes and grasses best suited to the soils that will be productive at the season when pasture is needed.
   (2) Inoculate the legumes.
   (3) Seed the pasture mixture in a companion crop that will control erosion; use not more than 1 bushel of oats per acre.
   (4) Cover seed lightly; use a cultipacker seeder or similar implement that will put seed at the proper depth. If seed is broadcast, a cultipacker will help cover the seed and firm the seedbed.

(5) Apply phosphate and potash at time of seeding. If fertilizer is broadcast, work it into the soil before seeding. Band seeding—drilling the fertilizer in a band 1 inch below the grass and legume seed—will help in getting the stand of pasture plants established.
(6) Pasture the companion crop when it is about 8 inches high to keep it from competing too strongly with young forage plants.

Pasture improvement and maintenance:

1. Control grazing:
   (1) Avoid overgrazing throughout the season.
   (2) Delay grazing in spring until the ground is firm and growth is well started.
   (3) Do not graze legume pastures for 1 month before the first hard frost in fall (normally September 1 to 30).
   (4) Divide the pasture into three or more parts and rotate the grazing. This gives the plants a chance to recover and prolongs the life of legumes and grasses.
2. Control weeds and brush:
   (1) Mow weeds before they set seed. Except where daily ration grazing is practiced, do the mowing before the livestock are removed from the pasture. Cattle will eat wilted weeds and vegetation from urine spots after this vegetation has been mowed.
   (2) Spray to control weeds and brush where spraying is more economical and effective than mowing.
3. Topdress with lime and fertilizer:
   (1) Lime acid soils to encourage whiteclover or similar legumes that will furnish nitrogen for the grasses in the pasture mixture.
   (2) Test the soils and apply phosphate and potash to increase yields.
   (3) Apply nitrogen to grass in spring if earlier grazing is desired. If enough moisture is available, nitrogen will increase the total yield of grass and improve its protein content. Repeated applications of nitrogen, however, will encourage grasses to force legumes out of the pasture mixture.

Woodland and Shelterbelts

Woodland:

1. Protect woodlands from fire and grazing.
2. Remove dead, dying, and deformed trees and undesirable species, but leave two den trees per acre for wildlife.
3. Plant open areas to suitable species, and underplant where desirable.
   (1) Plant Scotch pine for Christmas trees.
   (2) Plant jack pine only in the droughty sites.
   (3) Cut marketable timber according to the method suggested by men trained in woodland management.

Shelterbelts:

1. Plant suitable species on well-prepared land.
2. Include shrubs in the planting to catch snow and to furnish food and cover for wildlife.
3. Protect from fire and grazing.
4. Cultivate to control weeds until the plantings are well established.

Wildlife Areas

Maintenance and improvement:

1. Do not burn fence rows, roadsides, odd areas, or sloughs.
2. On upland soils, plant low-growing shrubs along permanent fences and maintain existing shrubs. Remove trees from fence rows because they take too much water from crops in adjoining fields.
3. Improve for wildlife the eroded spots in fields, bare knobs, small blowouts, large gullies, abandoned roads and railroad rights-of-way, borrow pits, gravel pits, and even bits of good land cut off from fields. Areas need to be at least one-fourth acre in size. Exclude livestock.
4. On upland soils, plant and maintain evergreens and shrubs in a rod-wide border between woods and crop fields.
5. Do not drain ponds and potholes suitable for wildlife.
6. Improve marshy areas by level ditching or water-level controls.

Irrigation and Drainage

At present, very little irrigation farming is being practiced in Scott County. However, irrigation is becoming increasingly important in the State for the production of high-value crops, especially in areas surrounding Minneapolis and St. Paul. It is reasonable to expect that as suburban housing developments take over truck-farming areas nearer the cities, truck farms and nurseries will develop in Scott County.

For persons interested in irrigating land in Scott County, the following suggestions apply:

1. See that an adequate, dependable source of water is available before purchasing equipment.
2. Obtain a permit to use water for irrigation whether the source is a lake, farm pond, stream, or well.
3. Choose productive land for irrigation.
4. Obtain good drainage to prevent waterlogging.
5. Select high-value crops responsive to irrigation.
6. Obtain technical assistance in checking water supply, in designing and laying out the irrigation system, and in practicing the soil management irrigation requires.

Listed in table 4 are several soils and land types of Scott County that need drainage. The table gives the minimum drainage specifications for these soils, but the feasibility of drainage on any given farm is a matter to be studied carefully by the individual operator. It is best to consult an experienced drainage engineer before attempting drainage of soils.

In the section on engineering, the soils of the county are rated according to suitability for sprinkler irrigation and their need for drainage. Characteristics of the soils that affect their use in construction of dikes, levees, reservoirs, and similar structures are pointed out.

TABLE 4.—*Minimum drainage requirements for several soils in Scott County, Minn.*

Soil	Tile			Open ditch				Remarks
				Outlet		Feeder		
	Depth	Spacing	Surface inlets	Side slopes	Bottom	Side slopes	Bottom	
	Feet	*Feet*		*Ratio*	*Feet*	*Ratio*	*Feet*	
Comfrey silty clay loam	4	100	Necessary if surface drainage is lacking.	2:1	4	4:1	(1)	The Comfrey is a bottomland soil subject to occasional overflow; check overflow problem before drainage.
Webster-LeSueur silty clay loams.	3	80						
Dundas silt loam, 0 to 2 percent slopes.	3	60		2:1	4	4:1	(1)	Tile drainage questionable; bedding suggested.
Glencoe silty clay loam	3½–4	80	Necessary	2:1	4	4:1	(1)	
Webster-Glencoe silty clay loams.	3½–4	80						
Peat, deep, 0 to 2 percent slopes.	4–4½	100–200	May be needed	1:1	4			Install outlet ditch at least 1 year before tile is laid; drainage of Peat, deep, 2 to 6 percent slopes, may not be feasible because of seepage.
Peat, deep, 2 to 6 percent slopes.	4–4½	100–200						
Beach materials and Muck	(2)	(1)	May be needed	2:1	4			Depth and spacing of tile depend on nature of underlying material; concrete tile can be used; drainage of Peat and Muck, shallow, 2 to 12 percent slopes, may not be feasible because of seepage, and interceptor tile may be needed to protect adjacent land.
Blue Earth silty clay loam, 0 to 3 percent slopes.								
Peat and Muck, shallow, 0 to 2 percent slopes.								
Peat and Muck, shallow, 2 to 12 percent slopes.								
Duelm fine sandy loam, 0 to 3 percent slopes.				1½:1	4			Tile drainage not suitable because of sand; do not dig ditches deeper than 1 foot in sand.
Isanti fine sandy loam								
Oshawa silty clay loam								Drainage not possible unless stream channel is deepened, levees are built, or both. Then take precautions to prevent backflow during floods.
Rauville silty clay loam								

[1] Variable.

[2] Depth variable, but minimum is 3½ feet.

How Scott County Soils Were Formed and Classified

This section is intended for soil scientists and others interested in the nature and origin of the soils in Scott County. The first part mentions the five major factors that interact to form soils. The second points out the soil-forming processes dominant in the county. In the third part, the soil series are arranged by order and great soil group and profiles of soils representative of each great soil group are described.

Factors of Soil Formation

The five main factors influencing soil formation are climate, vegetation, parent material, relief, and time. The nature of the soil at any point on the earth depends upon the combined influence of these five factors at that point. All five factors come into play in the genesis of every soil. The importance of each differs from place to place. In extreme cases, one factor may dominate in the formation of a soil and fix most of its properties, as is common when the parent material consists of pure quartz sand. Little

can happen to quartz sand, and the soils derived from it usually have faint horizons. Even in quartz sand, however, distinct profiles can be formed under certain types of vegetation if the topography is low and flat and a high water table is present. Thus, for every soil, the past combined influence of the five major factors is of first importance to its present character.

Climate

Scott County has a continental type of climate with wide variations in temperature from summer to winter. Generally, the soils are frozen 4 to 5 months out of a year. The depth to which frost penetrates depends mostly on the quantity of snow received late in fall or early in winter. The snow, while on the ground, prevents water erosion and slows down denitrification processes. During winter the soil-forming forces are largely dormant, though some alternate freezing and thawing still take place. The climate is essentially uniform over the entire county. For data on local temperature and precipitation, see the table in the subsection, Climate.

Vegetation

Two types of vegetation—forest and prairie—have strongly influenced soil development in Scott County (fig. 16). Most of Scott County, at the time of settlement, was forested, as it came within the southern part of the Minnesota Big Woods area. Included in this forested tract were a few prairie areas where tall grasses flourished. Soils in these prairie areas correlate very closely with Brunizem (Prairie) soils. But the boundary lines between prairie and forest apparently have shifted back and forth considerably. For this reason many of the grassland soils in Scott County are in a so-called ecological tension zone and are not so dark nor so highly developed as typical Brunizem soils.

Most of the soils in the county are more or less transitional between Brunizem and Gray-Brown Podzolic soils. Exceptions are the soils on river terraces, the soils in the eastern one-third of the county, and small areas in Helena and Belle Plaine Townships.

The soils transitional between prairie and forest are medium dark at the surface because of influence of prairie grasses. The subsurface layer, on the other hand, is the gray, podzolized horizon characteristic of forest soils. This podzolized horizon is thinner in those areas known as Aspen-Oak land and Aspen-Birch hardwoods. These vegetative associations evidently were the first to invade true prairie areas. The Aspen invasion was followed by the Big Woods invasion of

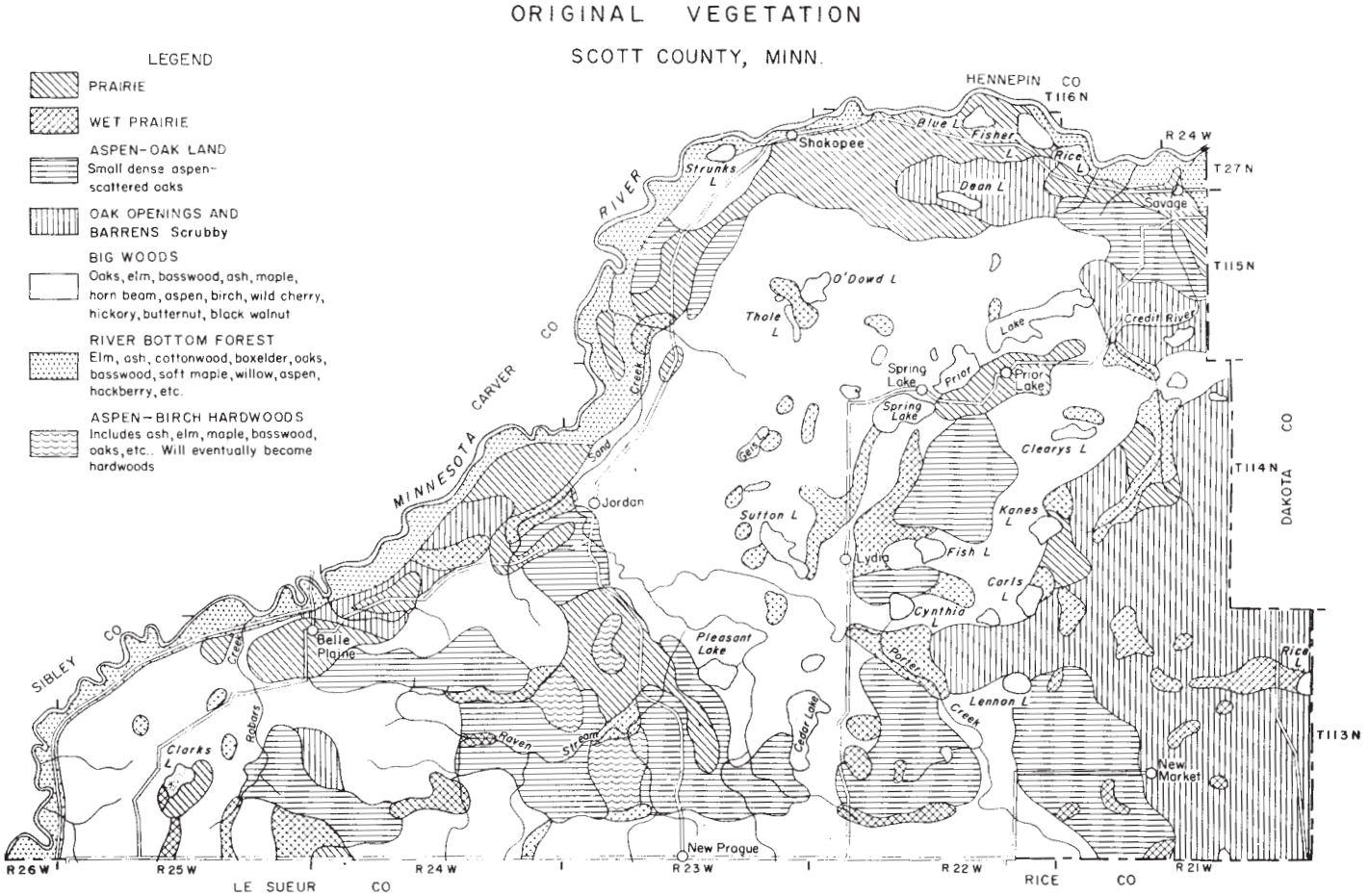


Figure 16.—**Original vegetation of Scott County, Minnesota.**

oak, elm, maple, basswood, hornbeam, aspen, birch, wild cherry, hickory, butternut, and black walnut. The two Aspen areas (Aspen-Oak and Aspen-Birch) were settled first; they were easier to clear because the trees were smaller. In the eastern one-third of the county, the forest cover had been established a long time. Here, there are Gray-Brown Podzolic soils with a pronounced A_2 horizon.

Prairie grasses have always tended to grow on the droughty soils of the terraces underlain by sand or gravel. Therefore, dark-colored soils classed as Brunizems have developed on the terraces.

Parent material

Scott County is in the Central Lowland province of the Western Young Drift section of the Interior Plains (*3*). It lies in a glaciated region characterized by young glaciated plains, moraines, lakes, and lacustrine beds.

The county is largely covered by drift of the Mankato substage of the Wisconsin glaciation. The glacial till varies in different parts of the county. On the eastern edge, in Credit River and New Market Townships, the Cary drift of the Wisconsin glaciation entered the county, mixed with the Mankato, and formed rough terminal moraines. This drift is often referred to as the Superior lobe and is reddish brown. The drift was derived largely from crystalline rocks of pre-Cambrian age—the rocks that outcrop in northeastern Minnesota and adjoining parts of Canada.

The high moraines formed from mixed Cary and Mankato drift are the end of the St. Croix moraine. The St. Croix joins the Bemis, Altamont, and Gary moraines that cover approximately the eastern two-thirds of Scott County.

In the areas occupied by Lester and Webster-Le-Sueur soils, the till is somewhat more plastic than elsewhere in the county and appears to have weathered rather completely. The origin of this till has not been determined (*4*). In the morainic area, particularly around Prior Lake, the drift includes pockets of sand and gravel. In the Burnsville and Lakeville soil areas, the till is loose, sandy and gravelly, and highly calcareous.

In general, the unstratified glacial drift of the Mankato age in the county is light yellowish-brown or light olive brown calcareous clay loam that is slightly mottled with pale yellow and gray. It is high in calcium and magnesium carbonates and effervesces strongly when hydrochloric acid is applied. It is composed of material derived mostly from limestone and calcareous shale.

Relief

The relief of the county varies from nearly level on the bottom lands and terraces to strongly rolling and hilly on the morainic parts of the upland. The variaitons in relief have affected drainage and the development of the soils (fig. 17).

On the bottom lands the soils have slow surface runoff and slow internal drainage. In addition, they are frequently flooded and thus receive deposits of silt.

The soils of the terraces are underlain by sand and gravel. They have good to rapid drainage. The Hubbard are good examples of soils on the terraces. They have rapid internal drainage because they have a coarse texture.

On the uplands, soils of the Clarion, Hayden, and Lester series are typical. They have medium surface runoff and medium internal drainage. They are among the soils of the county that show best the development that takes place when the factors of climate and vegetation are dominant.

In the depressions are Webster and Glencoe soils, which have restricted internal drainage and a mottled B horizon. Their water table lies 3 to 4 feet below the surface.

On the moraines, where surface runoff is rapid and loss of water is high, there are soils of the Burnsville, Hayden, Kingsley, and Scandia series. Here, relief and drainage are dominant over other factors of soil formation.

Time

Soils may be well developed, poorly developed, or somewhere in between, depending on the length of time that soil-forming factors have been active. The Clarion and similar soils, for example, have developed moderately distinct layers, or horizons. The Webster soils have less pronounced horizons than the Clarion because they occupy nearly level places where soil moisture is readily retained. The constantly moist condition inhibits soil-forming processes. Hubbard soils, mainly because of their droughtiness, have poorly developed profiles. Here, the fast percolation of water through the soil and the sparse vegetation preclude any real development. Soils formed from alluvial material, such as the Dorchester, show the effect of a short period of time in their limited development. Also, frequent floods have deposited additional material, so time has only slightly affected soil development.

Processes of Soil Formation

In Scott County the five factors of soil formation interact in such way that three processes are said to be dominant—podzolization, calcification, and gleization.

Podzolization (*6*) is the dominant soil-forming process in areas that have high humidity and forest vegetation. As reported, there are two phases to the process. In the first, leading to the formation of Podzols, a peaty mat of organic matter accumulates on the surface and iron compounds in combination with organic acids are moved from an upper to a lower layer. In the second phase, leading to the formation of Gray-Brown Podzolic soils, silicate clays move from an upper to a lower layer, and again the layer immediately below the organic surface layer is lighter colored than the rest of the profile. The clay is carried in suspension by percolating waters until it is deposited as films along channels or on the faces of the structural aggregates of the B horizon.

Some of the soils of Scott County have formed under a forest vegetation in a humid-temperate climate and

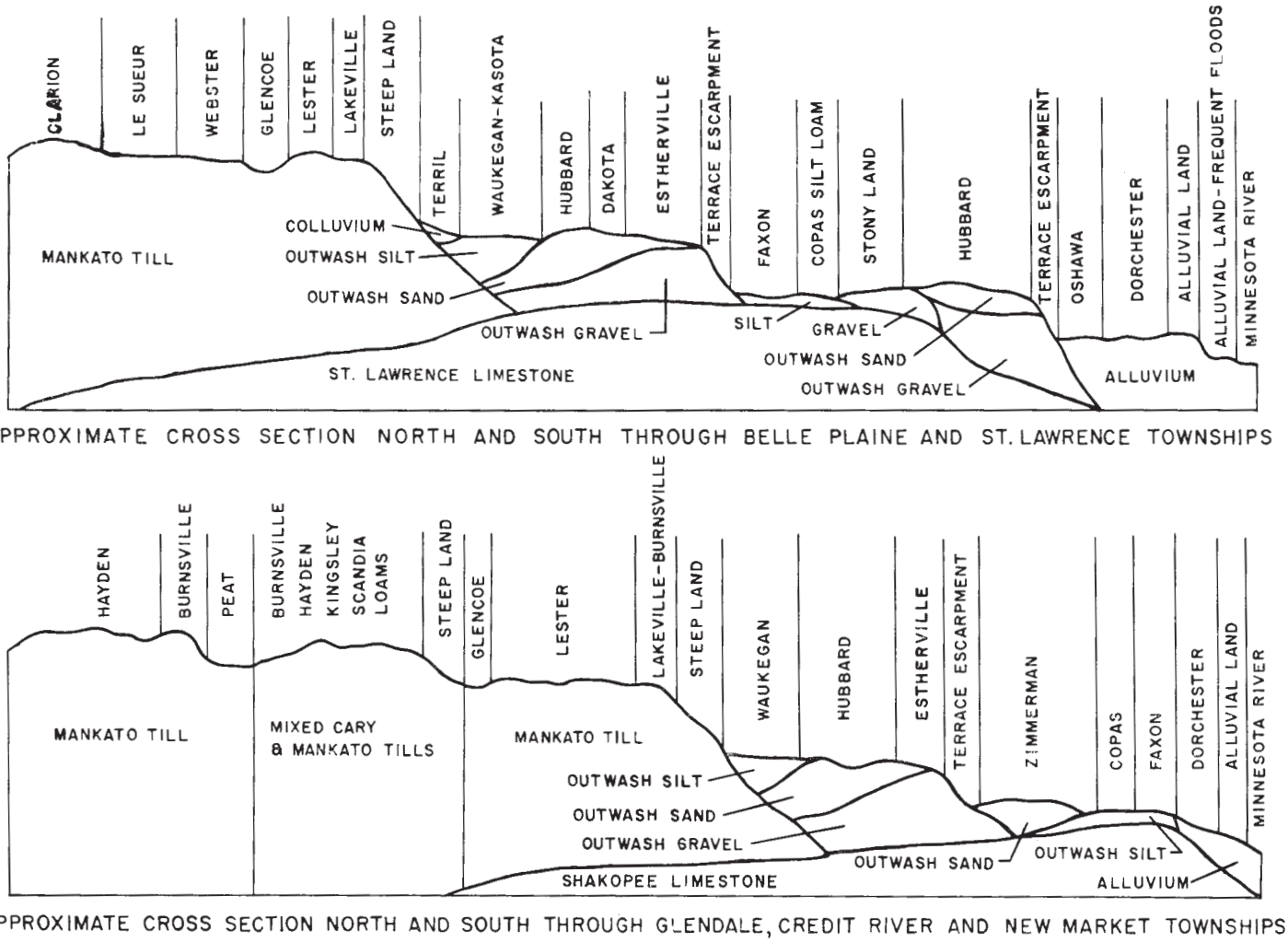


Figure 17.—**Schematic north-south diagram through Belle Plaine and St. Lawrence Townships and Glendale, Credit River, and New Market Townships, showing position and parent material of soil series.**

have been subjected to the second phase of podzolization that was mentioned earlier. Such soils in Scott County are classified as Gray-Brown Podzolic soils. They have a surface cover of leaf litter, ordinarily from deciduous trees; a dark, thin, only slightly or moderately acid humus, which is mixed with mineral soil; a grayish-brown, crumb-structured, loamy A_1 horizon over a light grayish-brown loamy A_2 horizon; and a moderately heavy, subangular blocky, yellowish-brown, brownish-yellow, or reddish-brown B horizon that becomes lighter colored with depth. The total depth of the solum varies considerably but seldom exceeds 4 feet.

The parent material of Gray-Brown Podzolic soils comes from a wide range of weathered rocks and minerals. In Scott County, the parent material is mainly clay loam calcareous till and the loose sandy or gravelly till of the Mankato stage of the Wisconsin glaciation. In places the parent material consists of the somewhat coarser till of the Cary stage of the Wisconsin.

Calcification (*6*) is a process normally restricted to regions in the temperate zone where rainfall is 25 inches or less and the dominant vegetation is grass or brush. In this process carbonates are redistributed in the profile but not entirely removed. Because of the low rainfall, not enough water percolates through the profile to remove entirely the calcium carbonate that existed in the parent material.

In the calcification process, calcium and magnesium carbonates accumulate at some point in the profile that approximates the depth to which surface waters most frequently percolate. A secondary result of the process is the somewhat granular condition of the soil material. The granulation results from the action of the carbonates on the clay colloids (fine clay) in this soil material. Also, because the colloids are thus influenced, there is little downward movement of colloids in the profile. The calcification process therefore involves accumulation of carbonates in the soil and the adsorption of calcium and magnesium ions by the clay colloids.

Vegetation contributes in the formation of soils influenced by calcification. Grasses and other plants requiring relatively large amounts of bases, particularly calcium, bring these bases to the surface through their roots. When the plants decay, the calcium is restored to the surface soil, and in this way the loss through leaching is at least partly offset. Soils formed through the process of calcification therefore seldom have a strongly acid surface soil.

In this county soils of the Brunizem great soil group have developed through the process of calcification. The Brunizems, however, have formed under a higher rainfall than is characteristic for lime-accumulation soils. Because of the higher rainfall, the average downward percolation of water in Brunizems under a good grass cover may be such that there is no zone in which calcium carbonate has accumulated. Yet these soils may possess a high degree of base saturation. The colloids of Brunizem soils are normally high in calcium, even though no free lime is present.

Vegetation and climate influence the calcification process in varying degrees. Where rainfall increases and grass gives way to forest, the Brunizems merge with the Gray-Brown Podzolic soils and other soils of forest regions. Scott County is in a transition zone between prairie and forest. Changes in climate have caused shifts in vegetation from prairie to forest, or the reverse. When forests invade the prairie, podzolization becomes active, and the dark color of the surface soil begins to be lighter, especially in the lower part. The upper horizons begin to take on the character of Gray-Brown Podzolic soils. The Lester soils in Scott County are representative of Brunizem soils being invaded by forests.

Generally the calcification process produces very fertile soils, some of them the most productive in the Corn Belt. The Clarion soils of this county are typical.

Gleization (*6*) is a process that takes place where parent material is nearly impervious to water or is located in such way that water continually stands at or slightly below the surface.

Abundant water encourages luxuriant growth of plants. The organic matter from the plants decays slowly because it is moist or wet. The plant remains are deposited faster than they decay, so a body of organic matter known as peat is built up.

Alternating wet and moist conditions prevail, and organic mottles are present; consequently, iron compounds are reduced to soluble forms and the solubility of calcium, magnesium, and manganese is increased. The usual result is a gray or bluish layer in the deep soil horizons and mottlings of olive, yellow, brown, and gray along root channels and cracks in the upper horizons. The bluish or greenish (olive) waterlogged horizons are called gley, and the process forming them is called gleization.

The gleization process is evident in the Glencoe and Webster soils of Scott County. They belong to the Humic Gley great soil group. Peat and Muck, the only Organic soils mapped in the county, are in the Bog great soil group. These Peat and Muck soils are composed of grasses, sedges, and reeds or of grasses and reeds.

Classification of Soils

The soil series of Scott County are classified by orders and great soil groups as shown in table 5. This table lists for each series the factors that have contributed to differences among the soils—parent material, relief, drainage, and vegetation. Climate and time are not listed in the table, though they have influenced development of the soils. Climate is essentially the same throughout the county and therefore does not contribute to differences among the soils. The effects of time are difficult to assess, but it is probable that time does not account for broad differences among the soils. The text describes profiles representative of the great soil groups in the county. Figure 18 will aid in understanding the position of the soils on the landscape, their parent material, and the nature of their profile.

Zonal soils

Zonal soils are well-developed soils that reflect the influence of the active factors of soil formation—climate and living organisms, chiefly climate. The zonal soils of this county have been placed in two great soil groups, the Brunizem, and the Gray-Brown Podzolic. Some of the soil series classed as Brunizems intergrade to Gray-Brown Podzolic.

BRUNIZEM SOILS

In the Brunizem great soil group are soils of the Clarion, Copas, Dakota, Estherville, Hubbard, Kasota, Lakeville, Lester, LeSueur, Terril, and Waukegan series. As shown in table 5, these soils differ somewhat in parent material, relief, drainage, and native vegetation. Differences in drainage are apparently most significant in causing differences among the soils of the group. Therefore, a representative profile is described for the well-drained soils and the excessively drained Brunizem soils. A profile is also described for the soils under grass-forest vegetation that were classed as Brunizems but have some characteristics of Gray-Brown Podzolic soils.

Clarion silt loam, 2 to 6 percent slopes, is representative of the well-drained Brunizem soils of the uplands that develop from glacial till under grass vegetation. A profile of Clarion silt loam, 2 to 6 percent slopes, is described as follows:

A_1 0 to 11 inches, black (10YR 2/1, moist) silt loam; moderate fine angular blocky and moderate fine granular structure; friable; slightly acid; abundant grass roots.

A_3 11 to 15 inches, very dark brown (10YR 2/2, moist) silt loam to clay loam; moderate to very fine angular blocky structure; friable, slightly acid; numerous grass roots.

B_1 15 to 19 inches, very dark gray to very dark grayish-brown (10YR 3/1 to 10YR 3/2, moist) clay loam; slightly sticky; moderate fine to very fine angular blocky structure; slightly acid; few to many grass roots.

B_{21} 19 to 30 inches, dark-brown (10YR 4/3 to 3/3, moist) clay loam; slightly sticky; moderate fine angular blocky structure; moderately acid; few grass roots; vesicular.

TABLE 5.—*Soil series of Scott County, Minn., classified by orders and great soil groups, and the parent material, relief, drainage, and native vegetation of each soil series*

Great soil group and soil series	Parent material	Relief	Internal drainage	Native vegetation
ZONAL				
Brunizem (Prairie) soils:				
Clarion	Calcareous till	Undulating to rolling	Medium	Tall prairie grasses.
Copas	Glacial outwash (shallow over bedrock).	Nearly level to undulating.	Rapid	Prairie grasses with clumps of oak.
Dakota	Glacial outwash	Nearly level to rolling	Medium to rapid	Prairie grasses.
Estherville	Glacial outwash	Nearly level to rolling	Rapid	Prairie grasses.
Hubbard	Glacial outwash	Nearly level to rolling	Rapid	Sparse grasses.
Kasota	Glacial outwash	Nearly level to undulating.	Medium	Prairie grasses.
Lakeville	Calcareous drift (gravelly and sandy).	Undulating to hilly	Medium to rapid	Prairie grasses and oaks.
Lester[1]	Calcareous till	Undulating to steep	Medium	Prairie grasses and hardwoods.
LeSueur[1]	Calcareous till	Nearly level	Slow	Prairie grasses and hardwoods.
Terril	Alluvial and colluvial material over calcareous till.	Gently sloping to moderately steep.	Medium	Prairie grasses and hardwoods.
Waukegan	Glacial outwash	Nearly level to rolling	Medium	Prairie grasses.
Gray-Brown Podzolic soils:				
Burnsville	Calcareous drift (gravelly and sandy).	Undulating to steep	Rapid	Hardwoods.
Hayden	Calcareous till	Undulating to steep	Medium	Hardwoods.
Kingsley	Slightly calcareous loamy red till	Undulating to steep	Medium	Hardwoods.
Scandia	Slightly calcareous red drift (gravelly and sandy).	Undulating to steep	Rapid	Hardwoods.
INTRAZONAL				
Humic Gley soils:				
Blue Earth	Lacustrine materials over calcareous till.	Nearly level (depressional).	Very slow	Reeds, sedges.
Duelm	Glacial outwash	Nearly level	Medium to slow	Grasses and sedges.
Faxon	Glacial outwash (shallow over bedrock).	Nearly level to gently sloping.	Very slow	Grasses, sedges.
Glencoe	Calcareous till	Nearly level (depressional) to gently sloping.	Very slow	Reeds, sedges.
Isanti	Glacial outwash	Nearly level (depressional).	Slow to very slow	Reeds, sedges.
Webster	Calcareous till	Nearly level to undulating.	Slow	Prairie and marsh grasses.
Planosol soil:				
Dundas[2]	Calcareous till	Nearly level to undulating.	Slow	Hardwoods.
Bog soils:				
Peat and Muck, and Peat.	Organic material (reeds and sedges).	Nearly level to gently sloping.	Rapid	Reeds and sedges.
AZONAL				
Alluvial soils:				
Dorchester	Recent alluvium	Nearly level	Medium	Hardwoods.
Comfrey	Recent alluvium	Nearly level	Medium to slow	Grasses.
Oshawa	Recent alluvium	Nearly level	Slow	Reeds and sedges.
Rauville	Recent alluvium	Nearly level	Slow	Reeds and sedges.
Regosol soil:				
Zimmerman[3]	Glacial outwash sand	Nearly level to rolling	Very rapid	Oaks.

[1] Brunizem grading to Gray-Brown Podzolic.
[2] Planosol intergrading to Humic Gley.
[3] Regosol grading to Gray-Brown Podzolic.

B_{22} 30 to 38 inches, dark yellowish-brown (10YR 4/4, moist) clay loam, with a few, fine, distinct strong-brown (7.5YR 5/6, moist) mottles; friable; moderate medium subangular blocky structure that breaks to weak fine subangular blocky; slightly acid; vesicular.

C_1 38 to 43 inches, dark yellowish-brown (10YR 4/4, moist) clay loam, with common, fine, distinct grayish-brown (2.5Y 5/2, moist) and brownish-yellow (10YR 6/8, moist) mottles; weak fine subangular blocky to massive structure; friable; neutral; vesicular.

C_2 43 inches +, same as C_1, but strongly effervescent when dilute hydrochloric acid is applied.

Hubbard loamy fine sand, 2 to 6 percent slopes, is representative of the excessively drained Brunizem soils of the terraces that develop from outwash sand under grass vegetation. A profile of Hubbard loamy fine sand, 2 to 6 percent slopes, is described as follows:

A_1 0 to 7 inches, very dark brown (10YR 2/2, moist) to very dark grayish-brown (10YR 3/2, moist) loamy fine sand; loose; very fine to fine weak granular to single grain; neutral.

A_3 7 to 20 inches, very dark grayish-brown (10YR 3/3, moist) fine sand; loose; fine weak subangular blocky to single grain structure; medium acid.

B 20 to 38 inches, very dark grayish-brown (10YR 3/3, moist) fine sand; loose; single grain; strongly acid; woody roots present.

C_1 38 to 48 inches, dark-brown (10YR 4/3, moist) fine sand; single grain to massive; loose; medium acid.

C_2 48 to 54 inches, dark-brown (10YR 3/3, moist) fine sandy loam; very firm; massive; medium acid.

C_3 54 inches +, pale-brown (10 YR 6/3, moist) fine sand; loose; single grain.

The Brunizem soils that intergrade to Gray-Brown Podzolic are members of the Lester and LeSueur series. Representative is the following profile description of Lester silt loam, 18 to 25 percent slopes, slightly and moderately eroded.

A_1 0 to 9 inches, black (10YR 2/1, moist) to dark-gray (10YR 4/1, dry) silt loam; friable; weak to moderate very fine to fine angular blocky structure; neutral; abundant grass roots.

A_2 9 to 14 inches, very dark gray (10YR 3/1, moist) to gray (10YR 5/1, dry) silt loam; friable; moderate very fine to fine angular blocky structure; slightly acid; abundant grass roots.

B_1 14 to 21 inches, very dark grayish-brown (10YR 3/2, moist) to grayish-brown (10YR 5/2, dry) clay loam; firm; strong fine to medium angular blocky structure; slightly acid; few woody roots.

B_2 21 to 35 inches, very dark grayish-brown (10YR 3/2, moist) to grayish-brown (10YR 5/2, dry) clay loam coated with very dark grayish-brown (10YR 3/2, dry) firm; moderate to strong medium angular blocky structure; strongly acid; few woody roots.

B_3 35 to 47 inches, dark grayish-brown (10YR 4/2, moist) to very dark grayish-brown (10YR 3/2, moist) clay loam; fine, common, distinct strong-brown (7.5YR 5/6, moist) mottles; very firm; strong medium to coarse angular blocky structure; strongly acid.

C_1 47 to 66 inches, light olive-brown (2.5Y 5/4, moist) clay loam coated with very dark grayish-brown (10YR 3/2, moist); common, fine, distinct yellowish-brown (10YR 5/8, moist) mottles; friable; moderate coarse angular blocky structure grading to massive; neutral.

C_2 66 inches +, dark grayish-brown (2.5Y 4/2, moist) clay loam; yellowish-brown (10YR 5/6, moist) mottles are common; friable; massive structure; moderately alkaline; slightly effervescent if dilute hydrochloric acid is applied; a few boulders in this layer, through the profile, and on the surface.

GRAY-BROWN PODZOLIC SOILS

The soils of Scott County in the Gray-Brown Podzolic great soil group are members of the Burnsville, Hayden, Kingsley, and Scandia series. The Burnsville, Kingsley, and Scandia are mapped together as soil complexes. Hayden loam, 6 to 12 percent slopes, is representative of the Gray-Brown Podzolic soils. A profile is described as follows:

A_1 0 to 2 inches, very dark brown (10YR 2/2, moist) loam; very friable; very thin to thin weak platy and very fine to fine weak granular structure; slightly acid; abundant grass roots.

A_2 2 to 9 inches, dark-gray (10YR 4/1, moist) loam; very friable thin moderate platy and very fine to fine moderate crumb structure; medium acid; numerous grass roots.

B_1 9 to 11 inches, dark grayish-brown (10YR 4/2, moist) clay loam; firm; very fine to fine moderate angular blocky structure; strongly acid; few grass and tree roots; krotavina between B_1 and B_{21}.

B_{21} 11 to 18 inches, dark grayish-brown (10YR 4/2, moist) silty clay loam; very firm; fine strong angular blocky structure; strongly acid; a few tree roots.

B_{22} 18 to 22 inches, dark-brown (10YR 4/3, moist) clay loam; firm; fine to medium strong angular blocky structure; strongly acid; a few tree roots.

B_{23} 22 to 26 inches, dark yellowish-brown (10YR 4/4, moist) clay loam; streaked and coated with very dark gray (10YR 3/1) friable; fine to medium moderate angular blocky structure; medium acid.

C_1 26 to 45 inches, yellowish-brown (10YR 5/6, moist) loam to clay loam; few, fine, distinct brown (7.5YR 4/4, moist) mottles; friable; massive; medium acid.

C_2 45 inches +, light olive-brown (2.5Y 5/6, moist) loam to clay loam; few, fine, distinct reddish-yellow (7.5YR 6/6, moist) and reddish-brown (5YR 4/4, moist) mottles; very friable; massive; moderately alkaline.

Shale fragments are prominent in the B_{21} and B_{22} layers; pebbles are scattered in the C_1 and C_2.

Intrazonal soils

Intrazonal soils reflect the dominance of some local factor, such as relief, parent material, or age, over the influence of climate and vegetation. The intrazonal soils of this county are members of the Humic Gley, the Planosol, and the Bog great soil groups.

HUMIC GLEY SOILS

The soils of the Humic Gley great soil group are members of the Blue Earth, Duelm, Faxon, Glencoe, Isanti, and Webster series.

Typical of the Humic Gleys in this county are soils of the Webster series. Following is a profile of Webster silty clay loam:

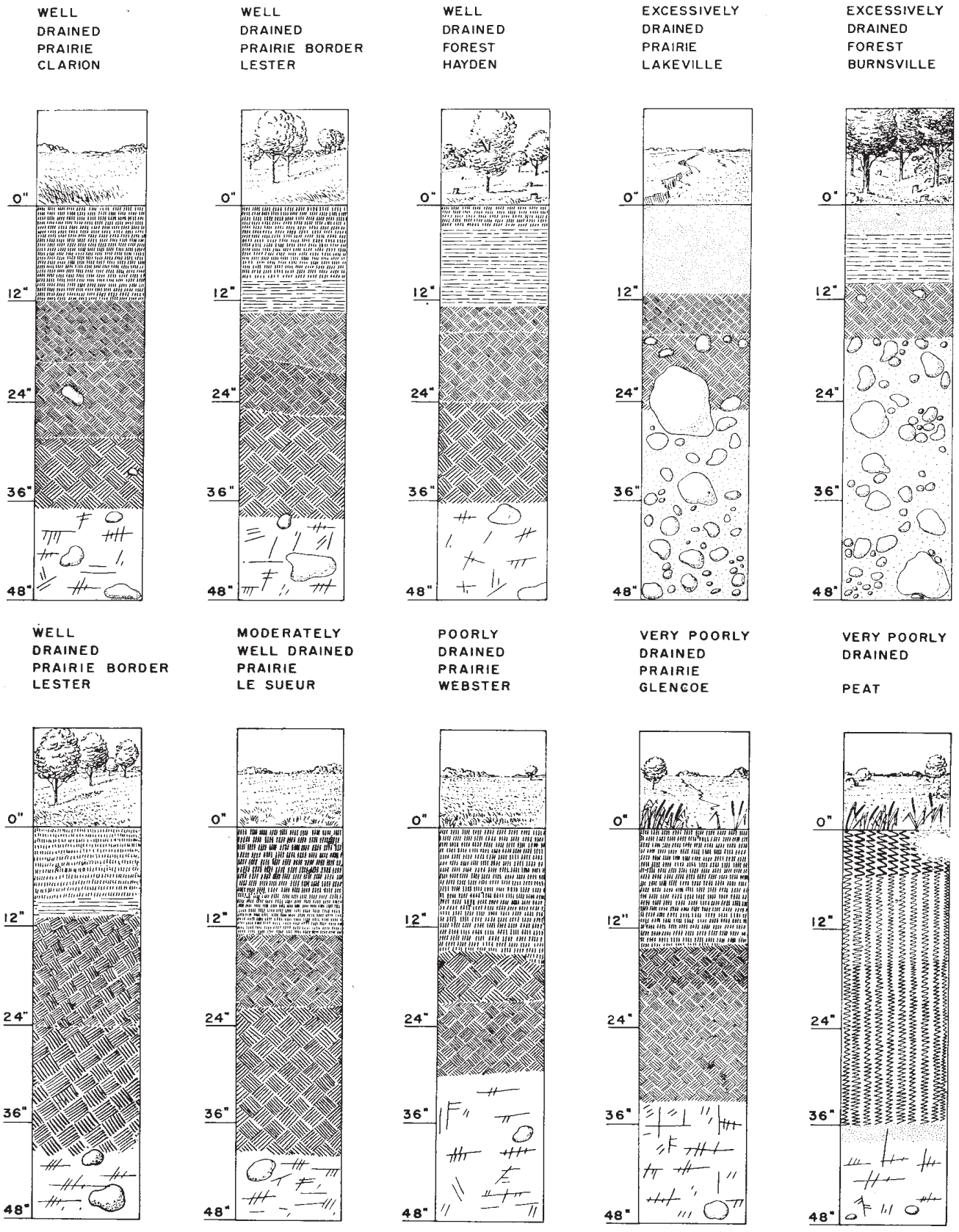
A_1 0 to 10 inches, black (10YR 2/1, moist) silt loam to silty clay loam; friable; very fine to fine moderate granular and very fine to fine moderate angular blocky structure; slightly acid; abundant grass roots.

A_3 10 to 15 inches, black (10YR 2/1, moist) silty clay loam; firm; very fine to fine moderate angular blocky structure; slightly acid; abundant grass roots.

B_1 15 to 21 inches, very dark brown (10YR 2/2, moist) to very dark grayish-brown (10YR 3/2, moist) silty clay loam; firm; fine to medium moderate angular blocky structure; strongly acid; numerous grass roots and some tree roots.

B_g 21 to 30 inches, grayish-brown (2.5Y 5/2, moist) clay loam to silty clay loam coated with very dark grayish-brown (10YR 3/2, moist); few, fine, distinct yellowish-brown (10YR 5/6, moist) mottles; very firm; fine moderate angular blocky structure; medium acid; some tree roots.

UPLAND SOILS



TERRACE SOILS

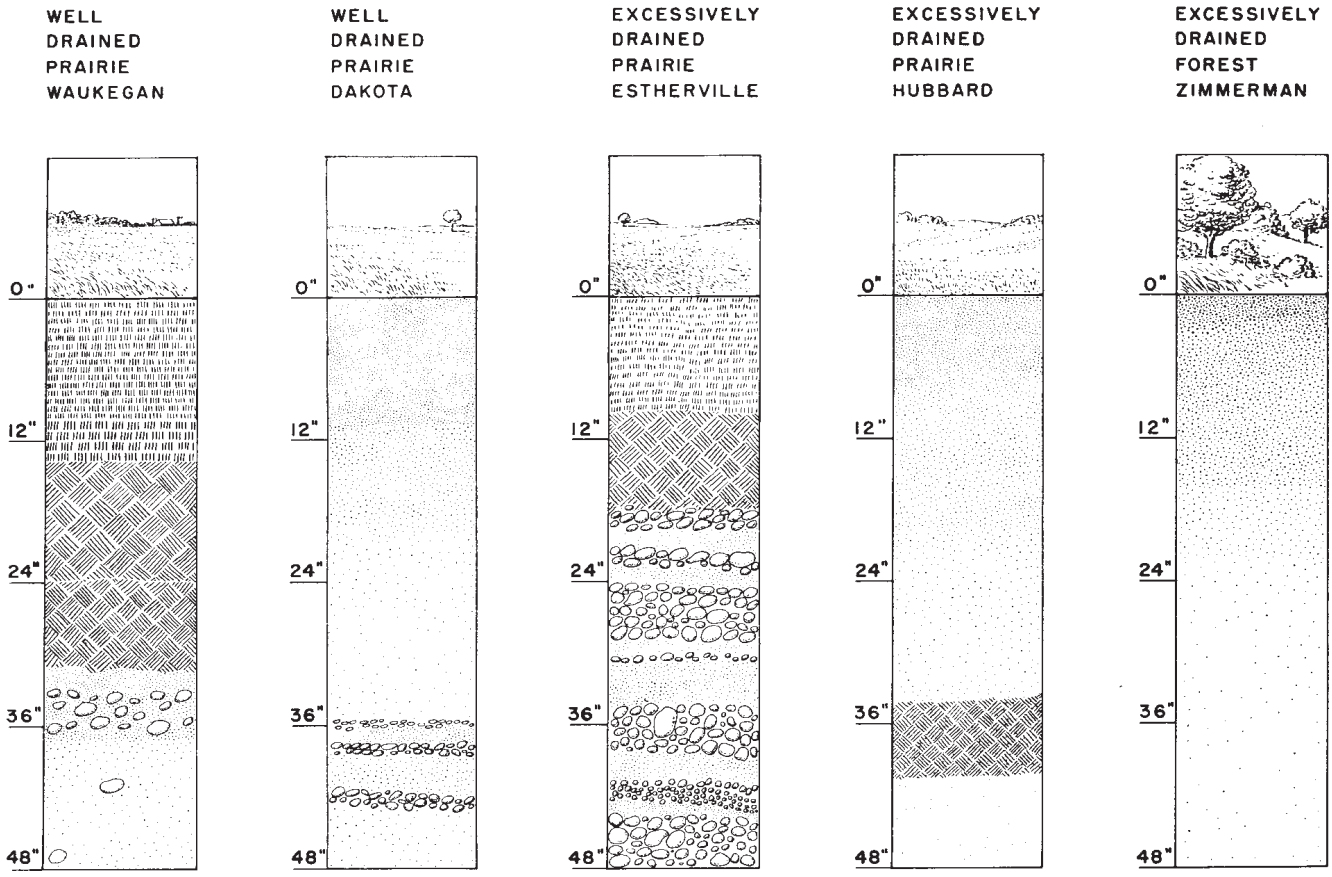


***Figure 18.*—Profiles of soils of the uplands and terraces, with explanatory legend.**

C_1 30 to 46 inches, olive-gray (5Y 5/2, moist) loam to clay loam; fine, prominent, strong-brown (7.5YR 5/6, moist) mottles; friable; massive; neutral.

C_2 46 inches +, pale-olive (5Y 6/3, moist) clay loam; many, coarse, prominent dark-brown (7.5YR 4/4, moist) and dark yellowish-brown (10YR 4/4, moist) mottles; friable; massive; mildly alkaline; horizon contains much shale, some sandy lenses, and old carbonized root channels.

PLANOSOL SOIL

The Dundas series, though classified as a Planosol, is an intergrade from the Planosol great soil group to the Humic Gley. The increase in clay content in the subsoil over the content in the surface and subsurface layers is the main characteristic that places the Dundas soils in the Planosol group instead of the Humic Gley.

BOG SOILS

In the Bog great soil group are the mapping units of Peat and Muck, and of Peat. These are very poorly drained organic soils in depressions.

Azonal soils

Azonal soils have little or no profile development. They are young soils. In this county the azonal soils belong to the Alluvial and the Regosol great soil groups.

ALLUVIAL SOILS

The Alluvial soils of this county are members of the Dorchester, Comfrey, Oshawa, and Rauville series. They are on bottom lands subject to occasional flooding and have no definite profile development.

REGOSOL SOIL

The Regosol great soil group is represented by one series, the Zimmerman. The Zimmerman soils are on wind-reworked sandy terraces. They show enough development to be considered as intergrades to the Gray-Brown Podzolic soils.

General Nature of the County

This section is intended primarily for readers not familiar with Scott County. It first tells about the physical geography of the county—the climate, physiography, and rivers and streams. Then the history, population, and public facilities are discussed. Finally, the agriculture of the county is summarized, mainly in terms of material selected from the United States Census of Agriculture.

Climate

Scott County has a continental climate characterized by pronounced seasonal variations in temperature. Precipitation is low in winter and high in summer. Climatic data in table 6 are from United States Weather Bureau records compiled at the Farmington station in Dakota County and at the Minneapolis station in Hennepin County. Records from Jordan station in Scott County were not used, as they were incomplete. Dakota and Hennepin counties are contiguous with Scott, however, and have almost the same weather conditions.

Most of the precipitation falls during the growing season, or from May through September. The maximum rainfall occurs in June. Thunderstorms are frequent, but usually only a few damage crops and erode the soil. Tornadoes and hailstorms occur but are not considered a serious hazard to farming, because they are rare.

The growing season is about 139 days in Scott County. At Farmington, the average date of the last killing frost in spring is May 13, and the average date of the first killing frost in autumn is September 29. Frost data from the Minneapolis station were not used because of the modifying effect of large cities on temperature, and hence on the growing season.

The climate is well suited to all the principal crops grown in this part of the State. If hybrid corn is cultivated, varieties that require from 110 to 116 days to mature are suggested.

Physiography, Relief, and Geology

Scott County is an area through which several ice sheets advanced and retreated during the glacial period. The most recent glacier (the Mankato stage of the Late Wisconsin) deposited a light yellowish-brown or light olive-brown, calcareous, moderately fine textured material of variable thickness. This deposit is probably more than 100 feet thick on the upland above the terraces.

Terminal moraines occupy the eastern two-thirds of the upland. These moraines are rolling to strongly rolling and in places are hilly. The Bemis, Altamount, and Gary moraines, which together make up this part of the county, are joined at the eastern boundary by the St. Croix moraine of the Cary stage of the Late Wisconsin glaciation. This St. Croix moraine extends only a short distance into Scott County. The rest of the upland is a nearly level to undulating till plain.

Along the Minnesota River is a flood plain ranging from a few feet to more than a mile wide on the Scott County side. Above this plain rise three well-defined terraces (*5*) : (a) Rock terraces 25 to 50 feet above the valley floor near Shakopee, Merriam Junction, and Jordan; (b) above the rock terraces two well defined terraces 75 and 150 feet above the river. These terraces, or outwash plains, were formed by melt water from the glacial Warren River. At the back margin of the terraces, the land rises in a rather steep bluff to the upland, which is 50 to 100 feet higher.

The rock terraces belong to the lower and middle Ordovician strata. At the city of Shakopee, the type section of the Shakopee dolomite (that is, the outcrop from which the type rock is named) may be seen in the old quarries in the valley wall. The city is built on a rock terrace, the surface of which is covered with alluvium deposited on the upper beds of the Shakopee dolomite.

The Jordan sandstone is exposed in the valley, a short distance upstream from Shakopee. It also crops out conspicuously west of United States Highway No. 169 in the region of Merriam Junction.

TABLE 6.—*Temperature and precipitation at two stations*

[Farmington, Dakota County, Minn., elevation, 902 feet]

Month	Temperature[1]			Precipitation[2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year	Wettest year	Average snowfall
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	18.7	63	−31	0.90	0.28	0.75	8.1
January	12.5	58	−40	1.02	.85	.43	9.4
February	15.3	63	−40	.87	.15	.87	7.7
Winter	15.5	63	−40	2.79	1.28	2.05	25.2
March	28.9	82	−30	1.38	.04	1.91	9.9
April	45.3	92	−1	2.09	.55	3.99	3.6
May	57.0	107	21	3.18	1.54	9.28	.3
Spring	43.7	107	−30	6.65	2.13	15.18	13.8
June	66.6	102	26	3.88	.43	5.87	[3]
July	71.5	110	41	3.25	2.65	5.13	0
August	69.2	105	36	3.25	2.03	3.25	0
Summer	69.1	110	26	10.38	5.11	14.25	[3]
September	60.6	103	20	3.32	1.66	7.16	[3]
October	48.2	90	2	2.19	1.67	.80	.5
November	31.9	80	−18	1.41	.50	2.04	5.4
Fall	46.9	102	−18	6.92	3.83	10.00	5.9
Year	43.8	110	−40	26.74	[4] 12.35	[5] 41.48	44.9

[Minneapolis, Hennepin County, Minn., elevation, 830 feet]

Month	Temperature[1]			Precipitation[2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year	Wettest year	Average snowfall
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	19.4	56	−27	0.85	0.31	0.55	7.4
January	14.6	52	−33	.80	1.08	1.96	9.6
February	18.2	64	−33	.89	.51	1.75	7.9
Winter	17.4	64	−33	2.54	1.90	4.26	24.9
March	30.9	83	−17	1.48	.09	9.00	8.3
April	46.0	86	9	1.91	.64	2.01	3.9
May	58.5	99	22	3.12	1.39	4.37	.2
Spring	45.1	99	−17	6.51	2.12	15.38	12.4
June	68.2	99	36	4.26	1.24	4.23	0
July	74.1	102	44	2.67	.74	3.09	0
August	71.5	100	42	2.79	1.56	2.81	0
Summer	71.2	102	36	9.72	3.54	10.13	0
September	62.2	98	29	2.85	2.58	2.82	[3]
October	50.4	90	10	1.65	.86	4.92	.6
November	33.0	73	−13	1.44	.59	4.13	4.3
Fall	48.8	98	−13	5.94	4.03	11.87	4.9
Year	45.6	102	−33	24.71	[6] 11.59	[7] 41.64	42.2

[1] FARMINGTON: Average temperature based on a 66-year record, through 1955; highest and lowest temperatures, on a 57-year record, through 1952. MINNEAPOLIS: Average temperature based on a 65-year record, through 1955; highest and lowest temperatures, on a 40-year record, through 1930.

[2] FARMINGTON: Average precipitation based on a 67-year record, through 1955; wettest and driest years based on a 66-year record, in the period 1888–1955, snowfall based on a 61-year record, through 1952. MINNEAPOLIS: Average precipitation based on a 65-year record, through 1955; wettest and driest years based on a 94-year record, in the period 1856–1955; snowfall based on a 42-year record, through 1930.

[3] Trace.

[4] In 1910.

[5] In 1938.

[6] In 1910.

[7] In 1868.

In the valley west of Jordan, the St. Lawrence formation is exposed. This is a buff sandy dolomite with green grains of glauconite sprinkled through it. Farther upstream, near Henderson, the Franconia formation, a fine-grained, greenish-gray sandstone, is exposed on the floor of the river.

Rivers and Streams

Most of Scott County lies within the Minnesota River watershed; the only part not in the watershed is an area of about 20 square miles in the southeastern corner (the eastern part of New Market Township). The headwaters of the Vermillion River drain most of this southeastern area.

The tributaries of the Minnesota River in Scott County are Robert (or Robars) Creek, Sand Creek, and the Credit River. Robert Creek is about 5 miles long and flows through the eastern part of Blakely Township. Sand Creek, draining the central part of the county, is about 20 miles long and extends into LeSueur County. Sand Creek has two tributaries, Porter Creek from the east, and Raven Stream from the west, both of which are 10 miles long. The Credit River, approximately 15 miles long, joins the Minnesota River at Savage.

Scott County has a considerable number of lakes, some large, and some small. Lakes and other inland water cover approximately 12 square miles. The largest lakes are Cedar, Spring, and Prior.

History, Population, and Public Facilities

HISTORY AND POPULATION.—Scott County was organized March 5, 1853, and the county seat was located at Shakopee on February 6, 1854. By 1860 the population had grown to 4,593, and by 1870 it was 11,042. The 1950 Census reports the population as 16,486.

Most of the original settlers in the county came from Germany, Norway, Ireland, and Czechoslovakia.

TRANSPORTATION AND MARKETS.—Four railroads serve the county: The Chicago, St. Paul, Minneapolis and Omaha Railway follows the Minnesota River on

the north and west sides of the county; it goes through Savage, Shakopee, Jordan, Belle Plaine, and Blakely. The Minneapolis and St. Louis Railway runs north and south through the center of the county and serves Jordan and New Prague. A branch line of the Chicago, Milwaukee, St. Paul, and Pacific Railroad serves Shakopee and Prior Lake, and another branch of the same railroad goes through Elko near New Market in the southeastern corner of the county. The Minneapolis, Northfield and Southern Railway serves Savage in the northeastern corner of the county.

United States Highway No. 169, a four-lane superhighway, crosses the county southwestward through Shakopee, Jordan, and Belle Plaine. Black-topped State highways serve most towns. Graveled county and township roads in good condition serve nearly every farm. Two bus lines provide service to Belle Plaine, Jordan, Shakopee, New Prague, Lydia, Prior Lake, and Savage. Terminal facilities for river barges are available at Savage.

Scott County is a part of the Minneapolis-St. Paul milkshed. Trucks pick up the whole milk daily. Livestock is marketed by truck in South St. Paul, and grain elevators are in nearly every town. There is a large malting plant at Shakopee, and a large soybean-processing, storage, and shipping facility at Savage.

COMMUNITY AND FARM FACILITIES.—Nearly all farms are electrified, and most of them have telephone service. Natural gas is piped to all the larger towns and to farms along the main pipelines.

SCHOOLS AND CHURCHES.—Some one-room elementary rural schools are still operating, although many of them have been consolidated. High schools are located at Belle Plaine, Jordan, Shakopee, Prior Lake, and New Prague. There are many churches, both rural and urban. The churches are largely Catholic and Lutheran, but there are churches of other Protestant denominations in the larger towns. Elementary parochial schools are operated by both Catholic and Lutheran churches.

Agriculture

Early agriculture in Scott County consisted of grain farming, principally the growing of wheat. In 1873, wheat was grown on more than half of the cultivated land (*1a*). At the same time, oats occupied about one-fifth of all cultivated land, and corn accounted for one-seventh of the acreage. Sheep, cattle, milk cows, and hogs were the important livestock.

CROPS.—Wheat was an important crop in Scott County until 1939. By 1939 rust epidemics that began about 1900 had reduced the acreage of wheat to approximately the area now planted (table 7).

Corn leads all other crops in acreage, oats is second, alfalfa is third, and soybeans are fourth. Alfalfa and soybeans have become important crops in the last 15 years.

The acreage in wild hay has dropped recently because the land has been drained and planted to corn. Large acreages of rye and barley were once grown, but these are now minor crops.

LIVESTOCK.—The number of livestock on farms has not changed much since 1910, but there has been a gradual increase in number of milk cows (table 8). The most important breed of dairy cattle is the Holstein-Friesian. Guernseys are next in importance. Mixed herds of these two breeds are common.

SIZE OF FARMS.—In 1954, the average farm in Scott County was 143.4 acres. The average cropland per farm was 86 acres. The trend has been toward an increase in size of farms.

TABLE 7.—*Acreage of principal crops grown*

Crop	1939	1949	1954
	Acres	*Acres*	*Acres*
Corn for all purposes	32,369	46,837	47,144
Small grains:			
Winter wheat	10,519	1,709	301
Spring wheat	4,174	1,986	829
Oats	20,093	33,388	34,200
Barley	8,101	1,660	470
Rye	1,998	1,037	408
Flax	304	1,458	348
Soybeans for all purposes	835	1,011	6,765
All hay	30,870	27,026	28,558
Alfalfa	12,981	15,048	21,952
Clover and timothy	2,817	1,580	1,062
Small grains cut for hay	1,082	308	136
Wild hay	8,002	7,121	3,878
Other hay	5,988	2,969	1,530
Sweet corn for home use or for sale	387	1,128	1,277
Peas (green) for home use or for sale	176	358	37

TABLE 8.—*Number of livestock on farms*

Livestock	1940	1950	1954
	Number	*Number*	*Number*
Horses and mules	[1] 6,460	3,072	1,330
Cattle and calves	[1] 29,741	32,915	39,443
Milk cows	18,331	18,903	20,079
Hogs and pigs	[2] 16,802	30,963	39,772
Chickens	[2] 158,517	[2] 225,312	[2] 312,211

[1] Three months old and over. [2] Four months old and over.

FARM EQUIPMENT.—Modern tractors, combines, cornpickers, and balers are used on many farms. Farmers who do not own these machines hire operators and machinery to do the necessary work.

Engineering Properties of Soils[2]

This section records the properties of soils important to engineering. It contains information that engineers can use to:

1. Make soil and land use studies that will aid in the selection and development of industrial, business, residential, and recreational sites.

[2] This section was prepared with data supplied by the Division of Physical Research, Bureau of Public Roads (see table 9). F. C. Frederickson, assistant materials and research engineer, and G. H. Holmquist, soils engineer, Minnesota State Highway Department, assisted in preparing parts of table 10 that particularly apply to highway construction.

2. Estimate runoff and erosion characteristics for use in designing drainage structures and planning dams and other structures for conserving soil and water.
3. Make reconnaissance surveys of soil and ground conditions that will aid in selecting highway and airport locations and in planning detailed soil surveys for the intended locations.
4. Locate sand and gravel for use in structures and for use as a base for both flexible and rigid pavements.
5. Correlate pavement performance with types of soil and thus develop information that will be useful in designing and maintaining the pavements.
6. Determine the suitability of soil units for cross-country movements of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and aerial photographs for the purpose of making soil maps and reports that readily can be used by engineers.
8. Become aware of the hazards or useful properties of various soils when used for highway and earth construction when definite laboratory data are lacking or not available.

The mapping and description of the soils are somewhat generalized, however, and the report therefore should be used only as a preliminary to more detailed field surveys to determine the in-place condition of the soil material at the site proposed for engineering construction.

Engineering Tests and Estimates

Most of the information about engineering properties of the soils is presented in tables 9, 10, and 11. Table 12 shows what properties are considered in classifying soils according to the system used by the American Association of State Highway Officials, and table 13, those properties considered in classifying soils by the Unified system.

Table 9 is the only source of data on laboratory tests. It provides for 5 soil types extensive in the county the results of laboratory tests for moisture-density, mechanical analyses, liquid limit, and plasticity index. It also gives the classifications of the samples according to the system of the American Association of State Highway Officials and according to the Unified system.

Since actual laboratory tests were made only for the soils listed in table 9, it was necessary to infer the engineering properties of the soils mapped by comparing them with soils analyzed in the laboratory and by study of soils in the field. These estimates, given in tables 10 and 11, provide much information that an engineer would otherwise have to obtain for himself, but the estimates are not a substitute for the detailed tests needed at a site selected for construction.

Some additional information useful to engineers can be obtained from the soil map and other sections of the report, particularly, Soil Associations; Soils of Scott County; How Scott County Soils Were Formed and Classified; and Physiography, Relief, and Geology.

Explanation of Methods and Terms

The following explanations of methods and terminology are provided because engineering uses of soils are of interest to farmers and others who have limited familiarity with engineering. Engineers can refer to the glossary for definition of terms used in soil surveying that may not be familiar to them.

CLASSIFICATIONS

A.A.S.H.O. classification.—The American Association of State Highway Officials has developed a classification based on the field performance of soil materials (*1*). In this system, soil materials are placed in seven principal groups (see tables 9, 10, and 12). The groups range from A-1, consisting of gravelly soils of high bearing capacity, to A-7, consisting of clay soils having low strength when wet. Within each group, the relative engineering value of the soil material is indicated by a group index number. The group index number is shown in parentheses, following the soil group symbol, in the next to last column in table 9. The characteristics considered in making the A.A.S.H.O. classification are shown in table 12.

Unified classification.—Some engineers prefer to use the Unified soil classification system (*2*). In this system, soil materials are identified as coarse-grained (8 classes), fine-grained (6 classes), or highly organic (see tables 9, 10, and 13).

DEFINITIONS

Moisture-density.—The relation of moisture content and the density of soil material are important in *compaction* for engineering purposes (see tables 9, 10, and 11). If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material will increase until the *optimum moisture content is reached.* After that, the density will decrease with increase in moisture content. The highest dry density obtained in the compaction test is the *maximum dry density.* Moisture-density tests in table 9 were made in accordance with A.A.S.H.O. Test Designation 99 (*1*).

Moisture-density data are important in earthwork for, as a rule, stability is obtained if a soil is compacted to about maximum density when it is at approximately the optimum moisture content.

Liquid limit.—The liquid limit is the moisture content at which the soil material passes from a plastic to a liquid state (see table 9).

Plastic limit.—As the moisture content of a clayey soil increases from a very dry state, the material changes from a solid to a semisolid or plastic state. The plastic limit is the moisture content at which the soil material passes from a solid to a plastic state.

Plasticity index.—The numerical difference between the liquid limit and the plastic limit is called the plasticity index. This index indicates the range in moisture content in which a soil is in a plastic condition. Nonplastic, indicated by NP, applies to soils that are granular or without cohesion, for which liquid or plastic limits cannot be determined (see table 9).

TABLE 9.—*Engineering test data*[1] *for soil samples*

Soil name and location	Parent material	Bureau of Public Roads report No.	Depth	Horizon	Moisture-density	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Hayden loam:						
500 feet N. of SE corner, SE¼SE¼ sec. 3, T. 113 N., R. 22 W. (Modal profile).	Mankato till	S31206	2–8.5	A_2	115	13
		S31207	11–17½	B_{21}	101	22
		S31208	45+	C_2	123	11
Center of SE¼SE¼ sec. 27, T. 115 N., R. 22 W. (Less developed, on steeper slopes than modal profile).	Mankato till	S31215	3–8	A_2	114	12
		S31216	10½–19½	B_{21}	113	14
		S31217	32+	C	119	12
20 rods W. of SE. corner, SW¼NE¼ sec. 21, T. 114 N., R. 21 W. (More silty and occurs on less steep slopes than modal profile).	Mankato till	S31212	3–0	A_2	119	10
		S31213	13–22	B_{21}	114	14
		S31214	41+	C_2	115	15
Hubbard fine sand:						
Center, NW¼NE¼ sec. 15, T. 115 N., R. 23 W. (Modal profile without bands).	Outwash terrace	S31235	4–12	A_3	108	13
		S31236	12–38	B	107	14
		S31237	38+	C	105	14
Hubbard loamy fine sand:						
NW. corner, SE¼SE¼ sec. 32, T. 114, N., R. 24 W. (Modal profile with band).	Outwash terrace	S31232	2–20	A_3	111	12
		S31233	20–38	B	109	13
		S31234	38–48	C_1	109	14
South-center, SW¼SE¼ sec. 12, T. 115 N., R. 22 W.	Outwash terrace	S31209	0–9	A_1	111	15
		S31210	14–23	B_2	107	14
		S31211	39+	C_2	102	15
Lester silt loam:						
NW. corner, NW¼NE¼ sec. 2, T. 113 N., R. 24 W. (Modal profile).	Mankato till	S31229	0–9.5	A_1	93	23
		S31230	14–23	B_{21}	104	19
		S31231	49+	C_2	109	16
SE. corner, SE¼NW¼ sec. 2, T. 114 N., R. 23 W. (Steep phase).	Mankato till	S31225	0–9	A_1	94	22
		S31226	21–35	B_{21}	102	18
		S31227	47–66	C_1	100	21
		S31228	66+	C_2	104	19
NE. corner, NE¼NW¼ sec. 10, T. 113 N., R. 23 W. (More plastic and clayey B horizon than in modal profile).	Mankato till	S31194	0–5	A_1	106	17
		S31195	14–32½	B_2	83	32
		S31196	41+	C_2	113	15
LeSueur silt loam:[6]						
NW¼NW¼ sec. 8, T. 113 N., R. 23 W. (Modal profile).	Mankato till	S31191	0–11	A_1	93	23
		S31192	16–22.5	B_{21}	103	18
		S31193	33+	C	110	17
NE. corner, NW¼SW¼ sec. 26, T. 113 N., R. 25 W. (Better drained than modal profile).	Mankato till	S31197	0–10	A_1	84	29
		S31198	16–25½	B_{21}	102	19
		S31199	31.5+	C	108	17
SW. corner, SW¼SE¼ sec. 12, T. 113 N., R. 23 W. (More plastic than modal profile).	Mankato till	S31203	0–9	A_1	83	31
		S31204	22–40	B_{22}	87	28
		S31205	50+	C_2	96	24
Webster silty clay loam:[7]						
NE. corner, NE¼SW¼ sec. 18, T. 113 N., R. 23 W. (Modal profile).	Mankato till	S31218	0–7	A_1	86	27
		S31219	12½–19	B_1	104	18
		S31220	19–37	B_{22}	102	21
		S31221	37+	C	109	18

See footnotes at end of table.

taken from 15 soil profiles, Scott County, Minn.

Mechanical analyses[2]														Classification	
Percentage passing sieve[3]									Percentage smaller than[3]				Liquid limit	Plasticity index	A.A.S.H.O.[4]	Unified[5]
½-in.	1-in.	¾-in.	⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
				100	98	89	81	62	55	39	23	15	23	5	A–4(5)	ML–CL
		100	99	98	93	86	80	62	60	48	39	33	49	26	A–7–6(13)	CL
		100	99	97	93	76	65	39	32	21	14	10	20	4	A–4(1)	SM–SC
				100	99	93	87	71	64	36	18	12	22	3	A–4(7)	ML
		100	99	98	95	86	80	63	56	40	28	24	34	17	A–6(8)	CL
		100	99	97	93	83	74	54	49	32	20	14	25	9	A–4(4)	CL
				100	98	84	71	49	42	28	14	10	19	2	A–4(3)	SM
			100	99	97	84	75	55	48	36	27	22	32	16	A–6(6)	CL
100	98	98	97	96	95	87	82	68	65	44	27	20	31	13	A–6(8)	CL
					100	99	82	11	8	7	5	5	NP	NP	A–2–4(0)	SP–SM
						100	81	9	7	6	5	5	NP	NP	A–3(0)	SP–SM
					100	99	80	7	5	4	3	3	NP	NP	A–3(0)	SP–SM
						100	91	15	12	10	7	6	NP	NP	A–2–4(0)	SM
						100	89	13	10	9	6	6	NP	NP	A–2–4(0)	SM
						100	93	14	11	9	7	6	NP	NP	A–2–4(0)	SM
					100	96	52	19	18	16	12	8	NP	NP	A–2–4(0)	SM
					100	97	52	9	6	6	5	4	NP	NP	A–3(0)	SP–SM
					100	96	51	5	4	4	3	3	NP	NP	A–3(0)	SP
					100	98	95	83	78	58	36	26	44	15	A–7–6(11)	ML
				100	99	97	95	86	80	55	35	28	38	15	A–6(10)	ML–CL
100	98	98	97	96	94	86	82	64	57	45	30	22	35	15	A–6(8)	CL
				100	98	92	85	67	61	46	29	22	43	14	A–7–6(8)	ML
				100	99	94	88	66	59	46	35	29	38	18	A–6(9)	CL
				100	98	92	86	68	62	51	36	29	47	23	A–7–6(13)	CL
			100	99	97	91	78	69	65	49	35	26	43	22	A–7–6(12)	CL
					100	97	93	69	62	42	28	22	31	11	A–6(7)	CL
						100	99	96	93	85	80	71	87	49	A–7–5(20)	MH–CH
	100	99	97	95	91	80	74	55	50	36	24	16	30	12	A–6(5)	CL
				100	99	94	88	69	65	51	37	30	43	15	A–7–6(9)	ML–CL
				100	98	90	82	62	58	44	34	30	40	19	A–6(9)	CL
		100	99	98	95	86	81	62	58	47	32	25	34	17	A–6(8)	CL
					100	96	92	78	73	56	32	24	54	17	A–7–5(14)	MH or OH
				100	99	97	92	71	65	45	31	25	40	18	A–6(10)	CL
					100	93	89	73	65	45	28	20	32	11	A–6(8)	CL
					100	98	96	88	85	65	42	30	55	19	A–7–5(15)	MH or OH
				100	98	93	90	81	77	66	51	41	66	36	A–7–5(20)	CH
			100	99	96	90	86	78	73	60	43	33	54	29	A–7–6(18)	CH
				100	99	94	88	69	65	49	31	24	51	16	A–7–5(11)	OH or MH
				100	99	93	88	68	62	49	33	25	36	16	A–6(9)	CL
			100	99	98	91	84	64	57	46	35	29	47	27	A–7–6(14)	CL
		100	99	98	96	88	83	63	57	45	30	20	35	16	A–6(8)	CL

TABLE 9.—*Engineering test data*[1] *for soil samples taken*

Soil name and location	Parent material	Bureau of Public Roads report No.	Depth	Horizon	Moisture-density	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
SE¼SW¼ sec. 36, T. 113 N., R. 25 W. (Less developed than modal profile).	Mankato till	S31200 S31201 S31202	0–11 14–25 30.5+	A_1 B_{21} C_2	87 98 100	27 22 21
SE¼SW¼SE¼ sec. 13, T. 113 N., R. 24 W. (More clayey than modal profile).	Mankato till	S31222 S31223 S31224	0–10 15–27 48+	A_1 B_g C_2	96 99 107	22 22 18

[1] Tests performed by Bureau of Public Roads in accordance with standard procedures of the American Association of State Highway Officials (A.A.S.H.O.).

[2] Mechanical analyses according to the American Association of State Highway Officials, Designation: T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the A.A.S.H.O. procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 mm. in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 mm. in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes of soils.

[3] Based on total material. Laboratory test data corrected for amount discarded in field sampling.

[4] The Classification of Soils and Soil-Aggregate Mixtures for Highway Purposes, A.A.S.H.O. Designation: M 145–49.

[5] The Unified Soil Classification System, Technical Memorandum No. 3–357, Volume 1, Waterways Experiment Station, March 1953.

[6] Profiles described are from an area mapped as LeSueur-Lester, but only the LeSueur soil was sampled.

[7] Profiles described are from an area mapped as Webster-LeSueur, but only the Webster soil was sampled.

TABLE 10.—*Description of soil and estimated physical*

Symbol on map	Soil name	Brief soil and site description	Typical depth of major horizons from surface	Classification	
				Unified	A.A.S.H.O.
			Inches		
AaA AaB Ab	Alluvial land, 0 to 2 percent slopes. Alluvial land, 2 to 6 percent slopes. Alluvial land, frequent overflow, 0 to 6 percent slopes.	Sand to clay textures; well drained to poorly drained; channeled areas flooded every spring and occasionally in other seasons; some areas have corrugations running parallel to stream.	Mixed characteristics; no classification of the		
Ba	Beach materials, sandy.	Narrow strips of loose sand around present and former lakes; water table ranges from surface to 3 or 4 feet below; a few stones or boulders in some places.	Mixed characteristics; no classification possible		
Bb	Beach materials and Muck.	Mixture of peat, muck, sand, and silt washed in or deposited by waves; surrounds lakes and beds of former lakes; poorly to very poorly drained; water table at or near surface.	Mixed characteristics; no classification possible		

from 15 soil profiles, Scott County, Minn.—Continued

Mechanical analyses[2]													Liquid limit	Plasticity index	Classification	
Percentage passing sieve[3]									Percentage smaller than[3]							
½-in.	1-in.	¾-in.	⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			A.A.S.H.O.[4]	Unified[5]
				100	99	96	92	81	73	61	42	32	52	20	A–7–5(14)	OH or MH
			100	99	97	89	83	67	62	52	41	33	51	25	A–7–6(14)	CH
				100	99	96	94	86	83	72	42	25	43	18	A–7–6(12)	ML–CL
					100	97	94	84	80	59	37	28	43	19	A–7–6(12)	OL or CL
			100	99	98	91	85	71	66	57	45	38	58	38	A–7–6(18)	CH
		100	99	98	96	90	85	67	60	50	35	27	40	22	A–6(11)	CL

properties significant to engineering, Scott County, Minn.

Grain sizes		Maximum dry density	Optimum moisture	Infiltration and permeability[1]	Structure[2]	Available water	Reaction (pH value)	Remarks
Passing No. 200 sieve	Passing No. 4 sieve							
Percent	*Percent*	*Lb. per cubic foot*	*Percent*	*Inches per hour*		*Inches per inch*		
Alluvial lands is possible								

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TABLE 10.—*Description of soil and estimated physical properties*

Symbol on map	Soil name	Brief soil and site description	Typical depth of major horizons from surface	Classification	
				Unified	A.A.S.H.O.
			Inches		
Bc	Blue Earth silty clay loam, 0 to 3 percent slopes.	1½ feet silty clay loam high in organic matter (5 to 8 percent by weight) underlain by clay loam; occurs in drained lake basins where water table is permanently between the surface and a depth of 2 feet; limestone bedrock at depth of not more than 10 feet in a large area near Savage.	0–24 24+	OL CL	A–4 A–6
BdB	Burnsville, Hayden, Kingsley, and Scandia loams, 0 to 6 percent slopes.	Complex of four soil types: Burnsville and Scandia soils underlain by gravel and sand, and the Hayden and Kingsley, by till; Hayden and Burnsville are from limy, gray glacial drift, and the Kingsley and Scandia are from reddish, acid drift; two kinds of drift materials are mixed and churned so that the individual soils could not be mapped separately.	Mixed characteristics; no classification possible		
BdC	Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes.				
BdC2	Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes, moderately eroded.				
BdD	Burnsville, Hayden, Kingsley, and Scandia loams, 12 to 18 percent slopes.				
BdD2	Burnsville, Hayden, Kingsley, and Scandia loams, 12 to 18 percent slopes, moderately eroded.				
BdE2	Burnsville, Hayden, Kingsley, and Scandia loams, 18 to 25 percent slopes, slightly and moderately eroded.				
BdF	Burnsville, Hayden, Kingsley, and Scandia loams, 25 to 50 percent slopes.				
BeD3	Burnsville, Hayden, Kingsley, and Scandia soils, 12 to 18 percent slopes, severely eroded.				
BeE3	Burnsville, Hayden, Kingsley, and Scandia soils, 18 to 25 percent slopes, severely eroded.				
CaB	Clarion silt loam, 2 to 6 percent slopes.	½ to 1 foot loam or silt loam high in organic matter (5 percent by weight), then 2 feet of loam or clay loam, and finally, calcareous loam or clay loam till; water table is deep in these soils of the uplands; a few boulders on surface and in profile.	0–12 12–36 36+	ML to CL ML to CL CL	A–7–6 A–6 A–6
CaB2	Clarion silt loam, 2 to 6 percent slopes, moderately eroded.				
CaC	Clarion silt loam, 6 to 12 percent slopes.				
CaC2	Clarion silt loam, 6 to 12 percent slopes, moderately eroded.				
CbC3	Clarion soils, 6 to 12 percent slopes, severely eroded.				
Cc	Comfrey silty clay loam.	1 to 2 feet of silty clay loam high in organic matter (5 to 8 percent by weight) over silty clay loam that continues to depths of 10 feet or more; soil is of limited extent and is on first bottoms along tributaries of the Minnesota River; moderately well drained to somewhat poorly drained.	0–24 24+	MH ML to MH	A–7 A–7
CdA	Copas silt loam, 0 to 2 percent slopes.	13 inches silt loam outwash, then 7 inches silt loam to clay loam, then 6 inches of clay loam containing pebbles and limestone fragments, and finally, limestone bedrock; soils are well drained and have no	0–13 13–20 20–26 [1]26+	ML to CL CL CL ---	A–7–6 A–7–6 A–6 ---
CdB	Copas silt loam, 2 to 6 percent slopes.				
CdB2	Copas silt loam, 2 to 6 percent slopes, moderately eroded.				

significant to engineering, Scott County, Minn.—Continued

Grain sizes		Maximum dry density	Optimum moisture	Infiltration and permeability[1]	Structure[2]	Available water	Reaction (pH value)	Remarks
Passing No. 200 sieve	Passing No. 4 sieve							
Percent	*Percent*	*Lb. per cubic foot*	*Percent*	*Inches per hour*		*Inches per inch*		
75	(3)	85	25	1–1.5	Granular	0.25	7.8	
70	100	105	15	1–1.5	Blocky	0.17–0.20	7.8	
70	100	95	23	0.5–1.0	Granular	0.20	6.5	Moderately eroded phases have 4 to 8 inches of surface; severely eroded phases, 0 to 3 inches.
70	96	100	20	0.8–2.5	Blocky	.18	6.5	
60	95	105	17	0.8–2.5	Massive	.17	7.8	
75	100	90	25	0.5	Granular	.25	7.0–7.5	
75	100	95	23	0.2–0.8	Massive	.17	7.5	
85	96	95	23	0.45	Granular	.20	6.1–6.5	Copas silt loam, 2 to 6 percent slopes, moderately eroded, has 4 to 8 inches of surface soil.
90	96	100	20	0.8–2.5	Blocky	.18	6.1–6.5	
60	80	105	17	0.8–2.5	Blocky	.18	5.6–6.0	
							7.5	

TABLE 10.—*Description of soil and estimated physical properties*

Symbol on map	Soil name	Brief soil and site description	Typical depth of major horizons from surface	Classification	
				Unified	A.A.S.H.O.
		water table above the bedrock, which is at depths of 12 to 35 inches; some boulders 3 to 4 feet in diameter.	*Inches*		
DaA	Dakota loam, 0 to 2 percent slopes.	1 foot loam, then 1 to 1½ feet of loam to sandy clay loam, and finally, sand that contains some gravel, most of it less than 2 inches in diameter; quantity of gravel increases with depth; gravel, usually stratified with sand, reaches to depths of 10 feet or more; these terrace or outwash soils are well drained; water table is deep; cuts may slough badly.	0–12	SC	A–4
DaB	Dakota loam, 2 to 6 percent slopes.		12–24	SC	A–4
DaB2	Dakota loam, 2 to 6 percent slopes, moderately eroded.		24–120	SP	A–3
DaC2	Dakota loam, 6 to 12 percent slopes, moderately eroded.		120+	GW	A–1 or A–3
DbA	Dakota sandy loam, 0 to 2 percent slopes.	1½ to 2 feet sandy loam, then loose sand to a depth of about 10 feet; below that depth material is stratified with fine gravel; these terrace or outwash soils are well drained; water table at depths greater than 10 feet; cuts may slough badly.	0–24	SM	A–2
DbB	Dakota sandy loam, 2 to 6 percent slopes.		24–120	SP	A–3
DbB2	Dakota sandy loam, 2 to 6 percent slopes, moderately eroded.		120+	GW	A–1 or A–3
DbC2	Dakota sandy loam, 6 to 12 percent slopes, moderately eroded.				
Dc	Dorchester loam and silt loam.	3 to 4 feet silt loam to silty clay loam underlain by silty material that contains lenses of fine sand; silty material continues to depths of 10 feet or more; these soils of the first bottoms slope slightly away from the river and are well drained to somewhat poorly drained; water table 2 to 6 feet from surfaces; soils are occasionally overflowed.	0–48	ML	A–4
Dd	Dorchester silty clay loam.		48+	ML	A–4
De	Duelm fine sandy loam, 0 to 3 percent slopes.	1 to 1½ feet fine sandy loam over fine sand; this is a somewhat poorly to poorly drained soil of the terraces; water table 2 to 6 feet from the surface.	0–18	SM	A–2
			18+	SP	A–3
Df	Dundas silt loam, 0 to 2 percent slopes.	1 foot of silt loam, then 2 to 3 feet of silty clay loam, and finally, calcareous clay loam till; this is a somewhat poorly to poorly drained soil of the uplands; in spring the water table is at depths of 2 to 5 feet in some places; subsoil not very permeable.	0–13	ML	A–7–6
			13–44	CL	A–7–5
			44+	CL	A–6
Dg	Dune land.	Loose sandy material being reworked by wind; severe blowouts and fresh dunes produce dunelike topography; soil very droughty; water table at depths of 10 feet or more; except near Savage.	0–60+	SP	A–3

significant to engineering, Scott County, Minn.—Continued

Grain sizes		Maximum dry density	Optimum moisture	Infiltration and permeability[1]	Structure[2]	Available water	Reaction (pH value)	Remarks
Passing No. 200 sieve	Passing No. 4 sieve							
Percent	*Percent*	*Lb. per cubic foot*	*Percent*	*Inches per hour*		*Inches per inch*		
40–45	90–100	110	15	0.5	Granular	0.20	6.1–6.5	Dakota loams that are moderately eroded have 4 to 8 inches of surface soil.
40–45	90–100	110	15	2.5–5.0	Blocky	.20	5.5–6.0	
5–10	80–90	105	14	5.0–10.0	Single grain	.015	6.1–6.5	
5–10	50–75	120	10	10.0+	Single grain		7.5	
30–35	90–100	110	15	0.6	Granular	.13	5.1–6.0	Dakota sandy loams that are moderately eroded have about 1½ feet of sandy loam surface soil.
5–10	80–90	105	14	5.0–10.0	Single grain	.07	6.1–6.5	
5–10	50–75	120	10	10.0+	Single grain	.015	7.5	
80	100	105	18	0.45	Massive	.18	7.5	
65–75	100	105	18	2.5–5.0	Massive	.17	7.5	
30–35	90–100	110	15	1.0	Granular	.07	7.0	
5–10	90–100	105	14	5.0–10.0	Single grain	.035	7.0	
60–70	99	115	13	0.25–1.0	Granular	.17	6.5–7.0	
70–80	99	87	28	0.2–0.5	Blocky	.17	5.6–6.5	
70–80	95	113	15	0.8–2.5	Massive	.17	7.5	
5–10	80–90	105	14	10+	Single grain	.035	5.0–6.0	

TABLE 10.—*Description of soil and estimated physical properties*

Symbol on map	Soil name	Brief soil and site description	Typical depth of major horizons from surface	Classification	
				Unified	A.A.S.H.O.
			Inches		
EaA	Estherville loam and sandy loam, 0 to 2 percent slopes.	1½ to 2 feet loam or sandy loam underlain by limy gravel; the gravel extends to depths of more than 10 feet; these are very well drained soils on terraces or outwash; water table at depths of more than 10 feet.	0–24	SC	A–2
EaB	Estherville loam and sandy loam, 2 to 6 percent slopes.		24+	GW	A–1 or A–3
EaB2	Estherville loam and sandy loam, 2 to 6 percent slopes, moderately eroded.				
EaC	Estherville loam and sandy loam, 6 to 12 percent slopes.				
EaC2	Estherville loam and sandy loam, 6 to 12 percent slopes, moderately eroded.				
EbB	Estherville gravelly sandy loam, 0 to 6 percent slopes.	½ to 1 foot loamy sand or gravelly sandy loam; limy gravel at surface or within 1 foot of surface; very well drained soils on terraces or outwash; water table below depth of 10 feet.	0–6	GC	A–1
EbB2	Estherville gravelly sandy loam, 0 to 6 percent slopes, moderately eroded.		6–60+	GW	A–1 or A–3
EbC	Estherville gravelly sandy loam, 6 to 12 percent slopes.				
EbC2	Estherville gravelly sandy loam, 6 to 12 percent slopes, moderately eroded.				
Fa	Faxon silty clay loam, 0 to 6 percent slopes.	1 foot of silty clay loam containing organic matter (5 to 8 percent by weight), then 1 to 1½ feet of clay loam to silty clay loam containing limestone fragments in lower part, and finally, limestone or sandstone bedrock; soils are poorly drained; water table ranges from surface to a depth of 2 feet; many boulders 2 to 4 feet in diameter on surface.	0–15	OL to CL	A–7–6
			15–29	CL	A–6
			[4] 29+		
Ga	Glencoe silty clay loam.	14 to 20 inches silty clay loam containing organic matter (5 to 8 percent by weight), then 12 inches of silty clay, and finally, clay loam till. Very poorly drained soil in depressions on the uplands; water table ranges from surface to depth of 3 feet; thin layers of peat on the surface in a few places.	0–20	OL to CL	A–7–6
			20–30	CH	A–7–6
			30+	CL	A–6
HaB	Hayden loam, 0 to 6 percent slopes.	About 1 foot of loam, then 2 to 3 feet of clay loam, and finally, loam or clay loam till; these are well-drained soils of the uplands; a few boulders on surface and throughout the profile; water table at depths of 10 feet or more.	0–12	ML to CL	A–4
HaB2	Hayden loam, 2 to 6 percent slopes, moderately eroded.		12–36	CL	A–6
HaC	Hayden loam, 6 to 12 percent slopes.		36+	CL	A–6
HaC2	Hayden loam, 6 to 12 percent slopes, moderately eroded.				
HaD	Hayden loam, 12 to 18 percent slopes.				
HaD2	Hayden loam, 12 to 18 percent slopes, moderately eroded.				
HaE2	Hayden loam, 18 to 25 percent slopes, slightly and moderately eroded.				
HaF2	Hayden loam, 25 to 35 percent slopes, slightly and moderately eroded.				
HcC3	Hayden soils, 6 to 12 percent slopes, severely eroded.				
HcD3	Hayden soils, 12 to 18 percent slopes, severely eroded.				
HcE3	Hayden soils, 18 to 25 percent slopes, severely eroded.				

significant to engineering, Scott County, Minn.—Continued

Grain sizes		Maximum dry density	Optimum moisture	Infiltration and permeability[1]	Structure[2]	Available water	Reaction (pH value)	Remarks
Passing No. 200 sieve	Passing No. 4 sieve							
Percent	*Percent*	*Lb. per cubic foot*	*Percent*	*Inches per hour*		*Inches per inch*		
35	85	115	12	0.6–1.3	Blocky	0.13	6.1–6.5	95 percent of soil material passes 3-inch sieve; in moderately eroded soils combined thickness of surface soil and subsoil (A and B horizons) is 12 to 18 inches.
10	50	125	8	10+	Single grain	.015	7.5	
20	50–75	120	10	0.6–1.3	Granular	.07	5.6–6.0	95 percent of soil material passes 3-inch sieve; in moderately eroded soils combined thickness of surface soil and subsoil (A and B horizons) is 4 inches.
10	50	125	8	10+	Single grain	.015	7.5	
60–80	80	95	22	0.4	Granular	.25	7.8	
60–80	70	90	26	0.8–2.5	Blocky	.17	7.8	
70–80	100	95	22	0.4	Granular	.25	7.0	
80	100	95–90	28	0.2–0.8	Blocky	.20	6.1–6.5	
65–80	95–100	110	18	0.8–2.5	Massive	.17	7.5	
60–70	100	115	12	0.25	Platy or granular	.18	5.5–6.0	Moderately eroded soils have surface soil 4 to 8 inches thick; severely eroded soils have surface soil 0 to 3 inches thick.
55–65	98	110	13	0.8–2.5	Blocky	.17	5.0–5.5	
40–65	95–98	115–120	11–13	0.8–2.5	Massive	.17	7.5	

TABLE 10.—*Description of soil and estimated physical properties*

Symbol on map	Soil name	Brief soil and site description	Typical depth of major horizons from surface	Classification	
				Unified	A.A.S.H.O.
			Inches		
HbB	Hayden sandy loam, 0 to 6 percent slopes.	About 1 foot sandy loam, then 1 to 2 feet of clay loam or loam, and finally, loam or clay loam till; pockets or lenses of sand and gravel in the till; a few boulders on surfaces and throughout profile; these are well-drained soils of the uplands; water table at depths of 10 feet or more.	0–12	SM	A–2 or A–4
HbB2	Hayden sandy loam, 0 to 6 percent slopes, moderately eroded.		12–36	ML to CL	A–4 or A–7–6
HbC	Hayden sandy loam, 6 to 12 percent slopes.		36+	SM to CL	A–4 or A–6
HbC2	Hayden sandy loam, 6 to 12 percent slopes, moderately eroded.				
HbD	Hayden sandy loam, 12 to 18 percent slopes.				
HbD2	Hayden sandy loam, 12 to 18 percent slopes, moderately eroded.				
HbE2	Hayden sandy loam, 18 to 25 percent slopes, slightly and moderately eroded.				
HbF2	Hayden sandy loam, 25 to 35 percent slopes, slightly and moderately eroded.				
HbD3	Hayden sandy clay loam, 12 to 18 percent slopes, severely eroded.				
HbE3	Hayden sandy clay loam, 18 to 25 percent slopes, severely eroded.				
HdA	Hubbard fine sand, 0 to 2 percent slopes.	1 foot of loamy fine sand to fine sand over fine sand; these are level to dunelike soils on river terraces or outwash; water table below depth of 10 feet; some gravel less than 2 inches in diameter at depths below 10 feet; cuts may slough badly.	0–12	SP to SM	A–2–4
HdB	Hubbard fine sand, 2 to 6 percent slopes.		12–38	SP to SM	A–3
HdB2	Hubbard fine sand, 2 to 6 percent slopes, moderately wind eroded.		38+	SP	A–3
HdC	Hubbard fine sand, 6 to 12 percent slopes.				
HdC2	Hubbard fine sand, 6 to 12 percent slopes, moderately wind eroded.				
HeA	Hubbard loamy fine sand, 0 to 2 percent slopes.	20 inches loamy fine sand over fine sand; bands of sandy loam, loam, or sandy clay loam an inch to a foot in thickness below depths of 3 or 4 feet; these are very well drained soils on river terraces or outwash; water table below depth of 10 feet; some gravel less than 2 inches in diameter below depth of 10 feet; cuts may slough badly.	0–20	SM	A–2–4
HeB	Hubbard loamy fine sand, 2 to 6 percent slopes.		20–38	SM	A–2–4
HeB2	Hubbard loamy fine sand, 2 to 6 percent slopes, moderately wind eroded.		38+	SM	A–2–4
HeC	Hubbard loamy fine sand, 6 to 12 percent slopes.				
HeC2	Hubbard loamy fine sand, 6 to 12 percent slopes, moderately wind eroded.				
Ia	Isanti fine sandy loam.	1 foot of highly organic loam or fine sandy loam, then 1 foot of sandy loam, and finally, fine sand; this is a very poorly drained soil in depressions on sandy terraces or outwash; water table ranges from surface down to depths of 2 feet.	0–12	SM	A–2–4
			12–26	SM	A–2–4
			26+	SP	A–3
KaA	Kasota silt loam, 0 to 2 percent slopes.	14 inches silt loam, then 12 to 15 inches of firm to very firm clay loam or silty clay loam, then 6 to 9 inches of gravelly sandy loam, and finally, calcareous gravel; these are well-drained soils on terraces or outwash; water table at depths of more than 10 feet.	0–14	ML	A–7–6
KaB	Kasota silt loam, 2 to 6 percent slopes.		14–27	CL	A–6
			27–33	GC	A–2
			33+	GW	A–1 or A–3

significant to engineering, Scott County, Minn.—Continued

Grain sizes		Maximum dry density	Optimum moisture	Infiltration and permeability[1]	Structure[2]	Available water	Reaction (pH value)	Remarks
Passing No. 200 sieve	Passing No. 4 sieve							
		Lb. per cubic foot						
Percent	*Percent*		*Percent*	*Inches per hour*		*Inches per inch*		
30–35	85–90	110	15	0.6	Platy or granular	0.13	5.5–6.0	
60–70	85–90	100	20	0.8–2.5	Blocky	.17	5.0–5.5	
30–50	80–85	120	11	0.8–2.5	Massive	0.07–0.17	7.5	
11	100	108	13	1.0	Single grain	.035	6.5	Moderately wind eroded soils have surface soil 4 to 8 inches thick.
9	100	107	14	5–10	Single grain	.035	5.6–6.0	
5–7	100	102–105	14–15	5–10	Single grain	.035	5.6–6.0	
15	100	111	12	1.0	Single grain	.07	5.6–6.5	Moderately wind eroded soils have surface soil 8 to 12 inches thick.
13	100	109	13	5–10	Single grain	.07	5.1–5.5	
14	100	109	14	5–10	Single grain	035	5.6–6.0	
30–35	100	100	21	1.0	Granular	.13	7.0	Thin layer of muck on surface in some areas.
15–20	100	110	15	5–10	Blocky	.12	7.0	
11	100	105	14	5–10	Single grain	.035	6.1–6.5	
50–65	95	95	23	.45	Granular	.20	6.0–7.0	
65–75	85–90	100	20	0.8–2.5	Blocky	.18	5.6–6.0	
25–35	50–60	115	12	5–10	Blocky	.17	5.6–6.0	
10	50	125	8	10+	Single grain	.015	7.5	

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TABLE 10.—*Description of soil and estimated physical properties*

Symbol on map	Soil name	Brief soil and site description	Typical depth of major horizons from surface	Classification	
				Unified	A.A.S.H.O.
			Inches		
LaA	Lakeville loam, 0 to 2 percent slopes.	16 inches of loam, then 9 inches of gravelly loam, and finally, calcareous gravel; these are well-drained soils of the uplands on gravelly drift; water table at depths of more than 10 feet; a few boulders on the surface and in the profile.	0–16	SC	A–2
LaB	Lakeville loam, 2 to 6 percent slopes.		16–25	GC	A–1
LaB2	Lakeville loam, 2 to 6 percent slopes, moderately eroded.		25+	GW	A–1 or A–3
LaC	Lakeville loam, 6 to 12 percent slopes.				
LaC2	Lakeville loam, 6 to 12 percent slopes, moderately eroded.				
LaD	Lakeville loam, 12 to 18 percent slopes.				
LaD2	Lakeville loam, 12 to 18 percent slopes, moderately eroded.				
LbB	Lakeville-Burnsville gravelly sandy loams, 0 to 6 percent slopes.	5 to 10 inches sandy loam, then 8 to 10 inches of loam or sandy loam, and finally, calcareous sand and gravel; these are well-drained soils of the uplands on gravelly drift; water table at depths of more than 10 feet; boulders and stones on the surface and throughout the profile.	0–5	SM	A–2
LbB2	Lakeville-Burnsville gravelly sandy loams, 0 to 6 percent slopes, moderately eroded.		5–21	SM	A–1
LbC	Lakeville-Burnsville gravelly sandy loams, 6 to 12 percent slopes.		21+	GW	A–1 or A–3
LbC2	Lakeville-Burnsville gravelly sandy loams, 6 to 12 percent slopes, moderately eroded.				
LbD	Lakeville-Burnsville gravelly sandy loams, 12 to 50 percent slopes.				
LcB	Lester silt loam, 2 to 6 percent slopes.	About 1½ feet silt loam, then 1½ to 2 feet of clay loam, and finally, calcareous clay loam till; these are upland soils; well drained; boulders up to 2 feet in diameter on surface and in profile; soils in this group are associated with those in the group immediately following.	0–14	ML	A–7–6
LcB2	Lester silt loam, 2 to 6 percent slopes, moderately eroded.		14–36	CL	A–6
LcC	Lester silt loam, 6 to 12 percent slopes.		36+	CL	A–6
LcC2	Lester silt loam, 6 to 12 percent slopes, moderately eroded.				
LcD	Lester silt loam, 12 to 18 percent slopes.				
LcD2	Lester silt loam, 12 to 18 percent slopes, moderately eroded.				
LcE2	Lester silt loam, 18 to 25 percent slopes, slightly and moderately eroded.				
LcF2	Lester silt loam, 25 to 35 percent slopes, slightly and moderately eroded.				
LdC3	Lester soils, 6 to 12 percent slopes, severely eroded.				
LdD3	Lester soils, 12 to 18 percent slopes, severely eroded.				
LdE3	Lester soils, 18 to 25 percent slopes, severely eroded.				
LdF3	Lester soils, 25 to 35 percent slopes, severely eroded.				
Le	LeSueur silt loam.	About 1 to 1½ feet silt loam to silty clay loam, then 2 feet of clay loam or silty clay loam, and finally, calcareous clay loam till; these are moderately well drained soils of the uplands; in places water table is 5 to 10 feet from surface in spring; soils of this group are closely associated with those in the preceding group.	0–13	MH	A–7–5
Lf	LeSueur-Lester silt loams.		13–36	CL	A–6
			36+	CL	A–6
Ma	Marsh.	Peaty material to depths of 30 feet or more; permanently wet; cattails and other marsh vegetation.	No classification possible		

significant to engineering, Scott County, Minn.—Continued

Grain sizes		Maximum dry density	Optimum moisture	Infiltration and permeability[1]	Structure[2]	Available water	Reaction (pH value)	Remarks
Passing No. 200 sieve	Passing No. 4 sieve							
Percent	*Percent*	*Lb. per cubic foot*	*Percent*	*Inches per hour*		*Inches per inch*		
35	85	115	12	0.45	Blocky	0.20	6.1–6.5	Moderately eroded soils have 8 to 12 inches of surface soil; 5 to 10 percent of gravel in soils will not pass a 3-inch screen.
10–20	60–70	120	10	5–10	Blocky	.17	6.1–6.5	
10	50	125	8	10+	Single grain	.015	7.5	
20	50–75	115	12	0.6	Granular	.13	6.1–6.5	Moderately eroded soils have 2 to 3 inches of surface soil; 10 to 15 percent of gravel in soils will not pass a 3-inch screen.
35	50–75	115	12	0.8–2.5	Blocky	.13	6.1–6.5	
10	50	125	8	10+	Single grain	.015	7.5	
70–80	100	93	23	0.45	Granular	.20	6.0	Moderately eroded soils have 8 to 10 inches of surface soil; severely eroded soils have 2 to 5 inches of surface soil.
65–86	100	103	18	0.8–2.5	Blocky	.18	5.0	
60–70	95	106	17	0.8–2.5	Massive	.17	8.0	
75–85	100	85	30	0.45	Granular	.20	6.0	
70–80	100	103	18	0.8–2.5	Blocky	.18	5.5	
70–80	99	110	17	0.8–2.5	Massive	.17	8.0	

TABLE 10.—*Description of soil and estimated physical properties*

Symbol on map	Soil name	Brief soil and site description	Typical depth of major horizons from surface	Classification	
				Unified	A.A.S.H.O.
			Inches		
Oa	Oshawa silty clay loam.	Silty clay loam underlain by stratified silts and fine sands at depths of 5 to 6 feet; very poorly drained soil on bottom lands; regularly overflowed; water table at or near surface.	0–60 60+	ML ML	A–7–6 A–7–6
PaA	Peat and Muck, shallow, 0 to 2 percent slopes.	Organic soils of varying depth: Mapping units of Peat and Muck, shallow, are less than 42 inches deep to mineral material, which is normally a clay loam till; mapping units of Peat, deep, 42 inches to 30 feet in depth, are in depression or seep areas on slopes; mapping units of Peat, deep, in sections 11 and 12 of Eagle Creek Township, are underlain by sand, but in sections 3 and 4 of the same township, they are underlain by limestone and sandstone bedrock.	(5)	(5)	A–8
PaB	Peat and Muck, shallow, 2 to 12 percent slopes.				
PbA	Peat, deep, 0 to 2 percent slopes.				
PbB	Peat, deep, 2 to 6 percent slopes.				
Ra	Rauville silty clay loam.	1½ feet silty clay loam high in organic matter (5 to 8 percent by weight) over silty clay loam that extends to depths of 10 feet or more; this is a very poorly drained soil of the bottom lands along tributaries of the Minnesota River; water table at or near surface, and water remains for long periods following floods.	0–18 18+	MH or OH CL	A–7–5 A–6
Sa	Sandstone outcrops.	6 inches or less of soil material over the Jordan sandstone bedrock.	No classification possible		
Sb	Steep land, Hayden-Lester materials.	Calcareous clay loam till that has been little altered by processes of soil formation; less than 10 percent of acreage has gravelly or sandy pockets in the till; a few boulders and stones throughout the till; land is in a narrow, steeply sloping belt between the terraces and the bottom lands, or between the terraces and the uplands, along the rivers and streams.	0–60+	CL SM and GW[6]	A–6 A–1 or A–3
Sc	Stony land.	Many granitic boulders 3 to 4 feet in diameter on surface; bedrock of limestone or sandstone at depths of 6 to 36 inches; bedrock is exposed in places; some low ridges (eskers or kames) of stones and coarse gravel included.	A variable land type that cannot be classified		
TbB	Terril sandy loam, 0 to 6 percent slopes.	2 feet sandy loam, then 2 feet loamy sand, and finally, calcareous clay loam till at a	0–28 28–48 48+	SM SP or SM CL	A–2–4 A–3 A–6
TbC	Terril sandy loam, 6 to 12 percent slopes.				

significant to engineering, Scott County, Minn.—Continued

Grain sizes		Maximum dry density	Optimum moisture	Infiltration and permeability[1]	Structure[2]	Available water	Reaction (pH value)	Remarks
Passing No. 200 sieve	Passing No. 4 sieve							
Percent	*Percent*	*Lb. per cubic foot*	*Percent*	*Inches per hour*		*Inches per inch*		
90	100	100	20	0.40	Granular	0.25	8.0	
75	100	105	18	0.2–0.8	Massive	.17	8.0	
				1.0		.50		
80–90	100	84	29	0.4	Granular	.25	7.5	2 or 3 inches of peat or silty muck in wetter areas.
80–90	100	105	17	0.2–0.8	Massive	.17	7.5	
40–60	95	115	12	0.25	Massive	.17	7.5	
		115–120	11–13	0.8–2.5	Single grain			
30–35	90	110	15	0.6	Granular	.13	7.0	
15	90	107	14	2.5–5.0	Single grain	.07	7.0	
50–70	96	119	12	0.8–2.5	Massive	.17	7.5	

TABLE 10.—*Description of soil and estimated physical properties*

Symbol on map	Soil name	Brief soil and site description	Typical depth of major horizons from surface	Classification	
				Unified	A.A.S.H.O.
			Inches		
TbD	Terril sandy loam, 12 to 18 percent slopes.	depth of about 4 feet; soil material deposited by gravity and by water on slopes below bluffs or other steep places along the Minnesota River.			
TbE	Terril sandy loam, 18 to 25 percent slopes.				
TcA	Terril silt loam, 0 to 2 percent slopes.	1½ feet silt loam high in organic matter (5 percent by weight), then 2½ feet of silt loam over clay loam calcareous till; soils are on slopes below river bluffs and other steep places; no stones in silty material in upper part; water table normally at depths of more than 10 feet; a few small seepy areas are included.	0–19	ML	A–7–6
TcB	Terril silt loam, 2 to 6 percent slopes.		19–47	ML	A–7–6
TcC	Terril silt loam, 6 to 12 percent slopes.		[7] 47	CL	A–6
TcD	Terril silt loam, 12 to 18 percent slopes.				
TcE	Terril silt loam, 18 to 25 percent slopes.				
Ta	Terrace escarpments.	Stratified sand and gravel in narrow steeply sloping areas between one terrace and another or between a terrace and the bottom lands.	0–60+	GW or SW	A–1 or A–3
WaA	Waukegan silt loam, 0 to 2 percent slopes.	1 foot silt loam moderately high in organic matter, then 1 to 2 feet of silt loam and very fine sandy loam, and finally, stratified sand and gravel; these are well drained soils on the terraces; water table at depths of 10 feet or more.	0–11	ML	A–7–6
WaB	Waukegan silt loam, 2 to 6 percent slopes.		11–31	ML	A–7–6
WaB2	Waukegan silt loam, 2 to 6 percent slopes, moderately eroded.		31+	GW	A–1 or A–3
WaC2	Waukegan silt loam, 6 to 12 percent slopes, slightly and moderately eroded.				
WaD2	Waukegan silt loam, 12 to 18 percent slopes, moderately eroded.				
Wb	Webster-Glencoe silty clay loams.	15 inches silty clay loam high in organic matter (5 to 8 percent by weight), then 1 to 1½ feet of silty clay loam to clay loam, and finally, calcareous loam or clay loam till; these are somewhat poorly to poorly drained soils of the uplands; water table 1 to 4 feet from surface in the spring; a few stones or boulders on the surface or in the profile.	0–15	MH or OH	A–7–5
Wc	Webster-LeSueur silty clay loams.		15–30	CL or CH	A–7–6
			30+	CL	A–6
ZaA	Zimmerman fine sand, 0 to 2 percent slopes.	10 inches fine sand over sand; these are well-drained soils of the terraces; water table at depths of 5 to 10 feet.	0–10	SP	A–3
ZaA2	Zimmerman fine sand, 0 to 2 percent slopes, moderately wind eroded.		10+	SP	A–3
ZaB	Zimmerman fine sand, 2 to 6 percent slopes.				
ZaB2	Zimmerman fine sand, 2 to 6 percent slopes, moderately wind eroded.				
ZaC2	Zimmerman fine sand, 6 to 12 percent slopes, slightly and moderately eroded.				

[1] Minimum infiltration rate is given for uneroded surface soil; for lower layers, the permeability value is given in inches per hour. For the eroded soils, the infiltration rate of the surface soil is about one-third less than given in this table.

[2] Type of structure as defined in the Soil Survey Manual (7).

[3] Material contains some shells.

[4] Bedrock at this depth.

[5] Peat.

[6] SM and GW materials occur in pockets.

[7] Underlying material, or D layer.

significant to engineering, Scott County, Minn.—Continued

Grain sizes		Maximum dry density	Optimum moisture	Infiltration and permeability[1]	Structure[2]	Available water	Reaction (pH value)	Remarks
Passing No. 200 sieve	Passing No. 4 sieve							
Percent	*Percent*	*Lb. per cubic foot*	*Percent*	*Inches per hour*		*Inches per inch*		
75–85	100	93	23	0.45	Granular	0.20	7.0	
75–85	100	105	16	2.5–5.0	Blocky	.18	7.0	
65–80	98	119	12	0.8–2.5	Massive	.17	7.5	
5–10	60–75	120–125	8–10	10+	Single grain	.015	6.0–7.5	
85	100	95	23	0.45	Granular	.20	6.1–6.5	Moderately eroded soils 4 to 8 inches of surface soil.
90	100	100	21	2.5–5.0	Blocky	.18	5.1–6.0	
5–10	50	125	8	10+	Single grain	.015	7.8	
70–85	100	86	27	[4]0.4	Granular	.25	6.1–6.5	
65–70	99	99	22	0.2–0.8	Blocky	.20	5.6–6.0	
60–75	98	107	18	0.8–2.5	Massive	.17	7.4–7.8	
5–9	100	105	14	1.0	Single grain	.035	5.6–6.0	Moderately eroded soils have about 5 inches of surface soil.
5–6	100	102	15	5–10	Single grain	.035	5.1–5.5 5.6–6.0	

TABLE 11.—*Suitability of the soils of Scott County, Minn., for use in various*

Soil	Suitability as source of—			Susceptibility to frost action[3]	Base needed for flexible pavement[3]	Use for foundations[3]	Use for embankments[3]
	Topdressing for cuts, fills, embankments, etc.[1]	Sand and gravel	Material in upper part of roadway[2]				
Alluvial land (AaA, AaB, Ab).	Poor to good; check each site.	Not suitable	Good to not suitable; check each site.	Moderate to high.	Thin to thick; check each site.	Fair to good, but variable; check each site.	Variable but generally fair to good; check each site.
Beach materials, sandy (Ba).	Not suitable	Suitable; high water table present.	Fair to poor	Slight	Thin	Fair to good; piping hazard through sand; toe drains suggested.	Fair to good; adequate strength and stability.
Beach materials and Muck (Bb).	Fair	Not suitable	Not suitable	Moderate	Thick	Poor down to underlying till; till fair.	Poor
Blue Earth (Bc)	Good	Not suitable	Not suitable	High	Thick	Poor down to underlying till; till fair.	Poor
Burnsville, Hayden, Kingsley, and Scandia (BdB, BdC, BdC2, BdD, BdD2, BdE2, BdF, BeD3, BeE3).	Poor	Suitable; pockets of sand and gravel can be found in these areas.	Good	Variable	Thin	Variable	Good
Clarion (CaB, CaB2, CaC, CaC2, CbC3).	Good	Not suitable	Poor in surface soil and subsoil; fair in till.	Moderate to high.	Moderate	Good; needs core trench into till.	Good
Comfrey (Cc)	Good	Not suitable	Not suitable	High	Thick	Poor; low strength; moderate to high compressibility.	Poor
Copas (CdA, CdB, CdB2).	Fair to good where boulders are not present.	Not suitable	Not suitable	Moderate; bedrock will limit capillary flow.	Thick	Fair to good; excessive water loss through fractured limestone bedrock.	Fair for low dams; quantities of material limited by shallow depth to bedrock; locate borrow areas outside reservoir area.
Dakota (DaA, DaB, DaB2, DaC2, DbA, DbB, DbB2, DbC2).	Good	Suitable for sand.	Good	Moderately susceptible in upper 2 feet; slight below.	Thin to moderate depending on whether pavement is placed on upper 2 feet or on material below 2 feet.	Fair to good; piping hazard through sandy substrata.	Fair to good; adequate strength and stability; locate borrow outside of reservoir area.
Dorchester (Dc, Dd).	Good	Not suitable	Not suitable	Moderate to high.	Moderate to thick.	Fair to poor	Fair

kinds of construction, and selected characteristics affecting construction

Use for dikes[3]	Compaction characteristics at or near optimum moisture[3]	Water impoundment	Erosion of cuts or fills	Drainage for agriculture[4]	Sprinkler irrigation[5]	Terracing	Remarks
Fair; side slopes should be 4 or 6 to 1.	Fair; roll in thin layers with pneumatic rollers.	Not suitable	Slight to moderate.	Not needed	Not suitable	Not suitable.	
Fair; side slopes should be 4 or 6 to 1.	Fair; pneumatic rollers suggested.	Poor	Severe; top-dress and mulch.	Usually not needed.	Not suitable	Not suitable	Classification uncertain because of mixed soil conditions.
Poor	Poor	Good; excavated ponds hold water because water table is high.	Slight	Needed	Not suitable	Not suitable	Classification uncertain because of mixed soil conditions.
Poor	Poor in surface 2 feet; fair below.	Good; excavated ponds hold water because water table is high.	Slight	Needed	Generally not suitable.	Not suitable.	
Good	Fair to good	Poor to fair; check each site.	Severe; top-dress, mulch, and seed or sod.	Not needed	Suitable; design of system would be difficult because of variable soil conditions.	Generally not suitable.	Substrata suitable as disposal field for septic tanks.
Good	Fair to good; roll in layers with 200 pound-per-square-inch sheepsfoot or equivalent.	Fair to good; reservoir bottom should be scarified and compacted.	Slight to moderate.	Not needed	Suitable	Suitable.	
Fair; side slopes should be 4 or 6 to 1.	Poor to fair; low density; requires heavy rollers.	Good	Slight	Needed; overflow hazard; few suitable outlets for drainage waters.	Suitable; complete drainage system required before soil can be irrigated.	Not suitable.	
Fair	Fair; subsoil material above bedrock satisfactory; use sheepsfoot or pneumatic roller.	Poor because of underlying bedrock.	Slight to moderate.	Not needed	Not suitable	Not suitable because of shallow depth to bedrock.	
Fair; side slopes should be 4 or 6 to 1.	Good in surface soil and subsoil; fair in substrata; pneumatic rollers suggested.	Poor; reservoir bottoms require seal blankets.	Severe	Not needed	Suitable	Suitable on Dakota loam; not suitable on Dakota sandy loam.	Suitable as disposal field for septic tanks.
Fair; flatten side slopes to 4 or 6 to 1.	Fair; requires rolling in thin layers with sheepsfoot; may require heavy rollers for high structures.	Poor to fair; reservoir bottoms require seal blankets.	Slight to moderate.	Not needed; subject to regular spring and summer flooding.	Suitable if soils are adequately protected from floods.	Not suitable.	

TABLE 11.—*Suitability of the soils of Scott County, Minn., for use in various*

Soil	Suitability as source of—			Susceptibility to frost action[3]	Base needed for flexible pavement[3]	Use for foundations[3]	Use for embankments[3]
	Topdressing for cuts, fills, embankments, etc.[1]	Sand and gravel	Material in upper part of roadway[2]				
Duelm (De)	Fair	Suitable for sand; high water table present.	Not suitable in upper 1½ feet; fair in substrata.	Slightly to moderately susceptible; water table close.	Thin to moderate.	Fair to good; piping hazard through fine sand substrata; toe drains suggested.	Fair to good; adequate strength and stability.
Dundas (Df)	Fair to good	Not suitable	Not suitable in upper 3 to 4 feet; fair in underlying till.	High	Thick, if pavement is placed on surface soil; moderate, if placed on the till.	Poor in surface soil; fair in subsoil to good in till substrata.	Poor to fair down to till; good in the till.
Dune land (Dg)	Not suitable	Suitable for poorly graded fine sands.	Fair	Slight	Thin	Poor to fair; high piping hazard.	Fair to poor, depending on gradation of sands; moderate to high permeability.
Estherville (EaA, EaB, EaB2, EaC, EaC2, EbB, EbB2, EbC, EbC2).	Fair to good	Suitable source of mixed sand and gravel; some shale fragments which may make material unsuitable for use in concrete.	Good	Slight	Thin	Good; highly permeable; cutoffs or core trenches not practical.	Good; adequate strength and stability.
Faxon (Fa)	Good, but boulders are a nuisance and must be removed.	Not suitable	Not suitable	High in all material above bedrock.	Thick	Poor down to bedrock.	Poor because of low strength, high water table, and shallow depth to bedrock.
Glencoe (Ga)	Good	Not suitable	Not suitable in upper 3 to 4 feet; fair in underlying till.	High	Thick	Poor to depth of 2½ to 3 feet; fair below; waste upper 2½ to 3 feet, or down to till.	Poor down to till; till is good if drained.
Hayden (HaB, HaB2, HaC, HaC2, HaD, HaD2, HaE2, HaF2, HcC3, HcD3, HcE3).	Good	Not suitable	Fair in surface soil; poor in subsoil; fair to good in till.	Moderate to high.	Moderate	Good in subsoil and till; moderate permeability.	Good; high density and stability.
Hayden sandy loam (HbB. HbB2, HbC, HbC2, HbD, HbD2, HbE2, HbF2, HbD3, HbE3).	Fair	Not suitable	Fair; till contains pockets of sand and gravel.	Variable	Moderate	Fair; pockets and layers of gravel or sand in the substrata may require use of deep cutoff trenches.	Good; high density and stability.

kinds of construction, and selected characteristics affecting construction—Continued

Use for dikes[3]	Compaction characteristics at or near optimum moisture[3]	Water impoundment	Erosion of cuts or fills	Drainage for agriculture[4]	Sprinkler irrigation[5]	Terracing	Remarks
Fair; flatten side slopes to 4 or 6 to 1.	Fair; pneumatic rollers suggested.	Poor; reservoir bottoms require seal blankets.	Moderate	Needed; seasonal high water table; shallow, wide-bottomed ditches suggested.	Not suitable	Not suitable.	
Fair to good	Fair in top 2 to 3 feet; good in underlying till; sheepsfoot roller suggested.	Good	Slight	Needed, with careful evaluation of compact layers in subsoil; results of tile drainage are variable.	Suitable; irrigation applications limited by compact subsoil; drainage required before irrigation.	Not suitable.	
Fair; flatten side slopes to 4 or 6 to 1.	Fair compaction with pneumatic rollers.	Not suitable	Severe	Not needed	Not suitable	Not suitable.	
Good	Good; high density; requires pneumatic rollers.	Not suitable	Severe	Not needed	Suitable	Generally not suitable.	Suitable as disposal field for septic tanks.
Poor	Poor; low density and strength; requires heavy roller.	Poor because of fractures and fissures in limestone.	Slight	Needed; water table high; drainage difficult to impractical because of shallow depth to limestone.	Not suitable	Not suitable.	
Poor	Poor in top 3 feet, which is of low density and hard to work; good in till.	Good; dugout ponds well suited.	Slight	Needed; tile and open ditches suggested.	Not suitable	Not suitable.	
Good	Good; compact with sheepsfoot roller.	Fair; scarify and compact reservoir bottoms.	Slight to moderate.	Not needed	Suitable	Suitable on slopes of less than 12 percent.	Place fields for septic tanks in the till.
Good	Good; compact with 200 pound-per-square-inch sheepsfoot roller or the equivalent.	Poor to fair; impervious blankets needed over sand or gravel strata in sandy loams; scarify and compact reservoir bottoms.	Slight to moderate.	Not needed	Suitable	Suitable on slopes less than 12 percent.	Place fields for septic tanks in the till.

TABLE 11.—*Suitability of the soils of Scott County, Minn., for use in various*

Soil	Suitability as source of—			Susceptibility to frost action[3]	Base needed for flexible pavement[3]	Use for foundations[3]	Use for embankments[3]
	Topdressing for cuts, fills, embankments, etc.[1]	Sand and gravel	Material in upper part of roadway[2]				
Hubbard (HdA, HdB, HdB2, HdC, HdC2, HeA, HeB, HeB2, HeC, HeC2).	Not suitable	Suitable; poorly graded fine sands.	Fair to good	Slight	Thin	Fair to good, depending on density; permeability moderate to high; seepage control necessary; cutoffs not practical; piping hazard.	Fair; moderate strength and stability.
Isanti (Ia)	Fair	Suitable; poorly graded fine sands. High water table present.	Not suitable in top 12 inches; fair in substrata.	Slight to moderate susceptibility, water table near surface.	Thin to moderate.	Fair to good; piping hazard through fine sand substrata; toe drains suggested.	Fair; adequate strength and stability.
Kasota (KaA, KaB).	Good	Suitable source of sand and gravel; some shale fragments may make soil unsuitable source of sand and gravel for concrete.	Poor in upper 2½ feet; but good below.	Moderate in upper 2 feet; slight below 2 feet.	Moderate to thick if placed on material in upper 2 feet; thin if placed on material below 2 feet.	Good; substrata rapidly permeable; cutoffs not practical.	Good; adequate strength and stability; locate borrow for embankment outside of reservoir areas.
Lakeville (LaA, LaB, LaB2, LaC, LaC2, LaD, LaD2).	Fair to good	Suitable source of sand and gravel.	Good	Moderate in upper 2 feet; slight below 2 feet.	Thin	Good; substrata rapidly permeable; cutoffs not practical.	Good; adequate strength and stability; locate borrow for embankments outside of reservoir areas.
Lakeville-Burnsville (LbB, LbB2, LbC, LbC2, LbD).	Not suitable	Suitable source of sand and gravel.	Good	Slight	Thin	Good; substrata rapidly permeable; cutoffs not practical.	Good; adequate strength and stability.
Lester (LcB, LcB2, LcC, LcC2, LcD, LcD2, LcE2, LcF2, LdC3, LdD3, LdE3, LdF3).	Good	Not suitable	Not suitable in upper 3 to 4 feet; fair to good in underlying till.	Moderate to high.	Moderate	Good in subsoil and till, which are moderately permeable.	Good
LeSueur (Le, Lf).	Good	Not suitable	Not suitable in upper 3 to 4 feet; fair to good in underlying till.	High	Moderate	Good in subsoil and till.	Good to fair
Marsh (Ma)	Characteristics unknown						
Oshawa (Oa)	Good	Not suitable	Not suitable	High	Thick	Poor because of low strength; moderate to high compressibility.	Poor

kinds of construction, and selected characteristics affecting construction—Continued

Use for dikes[3]	Compaction characteristics at or near optimum moisture[3]	Water impoundment	Erosion of cuts or fills	Drainage for agriculture[4]	Sprinkler irrigation[5]	Terracing	Remarks
Fair; flatten side slopes to 4 or 6 to 1.	Poor to fair; use pneumatic rollers.	Poor; blanket reservoir areas with impervious materials; dams need impervious blankets.	Severe	Not needed	Suitable	Not suitable	Substrata suitable as disposal field for septic tanks.
Fair; flatten side slopes to 4 or 6 to 1.	Fair; pneumatic rollers suggested.	Poor for dugout ponds.	Moderate to severe.	Needed; seasonal high water table; shallow wide-bottomed ditches suggested.	Not suitable	Not suitable.	
Good	Good in substrata; use pneumatic rollers.	Poor to fair if gravel is not exposed; scarify and compact reservoir bottoms.	Slight	Not needed	Suitable	Suitable	Substrata suitable as disposal field for septic tanks.
Good	Good in substrata; use pneumatic rollers.	Poor; blanket reservoir areas with impervious materials; dams need impervious blankets.	Slight	Not needed	Suitable	Suitable on slopes of less than 12 percent.	Substrata suitable as disposal field for septic tanks.
Good	Good; high density requires pneumatic rollers.	Not suitable for ponds; dams need impervious blankets.	Moderate to severe.	Not needed	Not suitable	Generally not suitable.	Substrata suitable as disposal field for septic tanks.
Good	Fair to good; roll in layers with 200 pound-per-square-inch sheepsfoot roller or the equivalent.	Good; scarify and compact reservoir bottoms.	Slight to moderate.	Not needed	Suitable	Suitable on slopes of less than 12 percent.	
Good	Fair to good; roll in layers with 200 pound-per-square-inch sheepsfoot roller or the equivalent.	Good; scarify and compact reservoir bottoms.	Slight	Not generally needed.	Suitable	Not suitable.	
Fair with side slopes of 4 or 6 to 1.	Fair to poor; requires rolling in thin layers with sheepsfoot; may require heavy rollers for high compaction.	Good for dugout ponds because water table is high.	Slight	Drainage needed; overflow hazard; outlets usually lacking.	Not suitable	Not suitable.	

TABLE 11.—*Suitability of the soils of Scott County, Minn., for use in various*

Soil	Suitability as source of—			Susceptibility to frost action[3]	Base needed for flexible pavement[3]	Use for foundations[3]	Use for embankments[3]
	Topdressing for cuts, fills, embankments, etc.[1]	Sand and gravel	Material in upper part of roadway[2]				
Peat and Muck (PaA, PaB, PbA, PbB).	Fair to good	Not suitable	Not suitable	High	Thick; remove material down to mineral soil.	Poor	Not suitable
Rauville (Ra)	Good	Not suitable	Not suitable	High	Thick	Fair to poor; fair strength.	Poor to fair
Sandstone outcrops (Sa).	No classification possible						
Steep land, Hayden-Lester materials (Sb).	Fair to not suitable.	Not suitable	Fair to good	Moderate to high.	Moderate	Good in till because of strength and moderate permeability; strata and pockets of sand and gravel may require deep cutoff trenches.	Good; high density and stability.
Stony land (Sc).	Not suitable	Variable; some stony or cobbly ridges contain gravel.	Poor to fair	Slight	Varies; check each site.	Bedrock	Not enough material for building.
Terril (TbB, TbC, TbD, TbE, TcA, TcB, TcC, TcD, TcE).	Good	Not suitable	Fair to good in underlying till; poor in surface layers.	High	Moderate to thick.	Good below depth of 4 feet; moderately permeable; extend core trench into till.	Good in material below the dark-colored material.
Terrace escarpments (Ta).	Not suitable	Suitable; usually sand; gravel, or both, but also may contain finer material.	Good	Slight	Thin	Good strength; highly permeable; cutoffs and core trenches not practical.	Good; adequate strength and stability.
Waukegan (WaA, WaB, WaB2, WaC2, WaD2).	Good	Suitable source of sand and gravel; some shale fragments may make sand and gravel unsuitable for making concrete.	Poor in upper 2½ feet; good below 2½ feet.	Moderate in upper 2½ feet; slight below that depth.	Thick, if upper 2½ feet is not removed; thin, if below 2½ feet.	Good below depth of 2½ feet; highly permeable; cutoffs and core trenches not practical; possible piping hazard.	Good; adequate strength and stability; locate borrow for embankment outside of reservoir areas.
Webster-Glencoe and Webster-LeSueur (Wb, Wc).	Good	Not suitable	Not suitable in upper 3 to 4 feet; fair to good in till below 3 to 4 feet.	High	Thick	Poor in surface soil, fair in subsoil, good in till substrata.	Poor to fair down to till; good in till.

kinds of construction, and selected characteristics affecting construction—Continued

Use for dikes[3]	Compaction characteristics at or near optimum moisture[3]	Water impoundment	Erosion of cuts or fills	Drainage for agriculture[4]	Sprinkler irrigation[5]	Terracing	Remarks
Poor	Not suitable	Not suitable	Slight	Drainage needed; usually drained with open ditches and tile laterals.	Suitable; adequate drainage required before irrigation.	Not suitable.	
Fair with side slopes of 4 or 6 to 1.	Fair to poor; requires rolling in thin layers with sheepsfoot; may require heavy rollers for high compaction.	Good for dugout ponds because water table is high.	Slight	Drainage needed; overflow a hazard; outlets usually lacking.	Not suitable	Not suitable.	
Good	Good; compact with sheepsfoot roller.	Fair to good; reservoir bottoms should be scarified and compacted; blankets of impervious material needed over pockets or strata of sand and gravel.	Slight to moderate.	Not needed	Not suitable	Not suitable; too steep.	
Not enough material for building.	Variable; check material at each site.	Not suitable	Slight	Not needed	Not suitable	Not suitable.	
Fair	Fair; roll in layers with 200 pound-per-square-inch sheepsfoot roller or the equivalent.	Poor to fair; scarify and compact reservoir bottoms.	Slight to moderate.	Not needed	Suitable	Suitable on slopes less than 12 percent.	
Good	Good; high density requires pneumatic roller.	Not suitable	Severe	Not needed	Not suitable	Not suitable.	
Good	Fair in top 2½ feet; good in substrata; compact with pneumatic roller.	Poor to fair if gravel is not exposed; scarify and compact reservoir bottoms.	Slight	Not needed	Suitable	Suitable on slopes of less than 12 percent.	Substrata suitable for septic tank disposal field.
Fair	Fair in top 3 to 4 feet; good in underlying till; roll in layers with 200 pound-per-square-inch sheepsfoot or equivalent.	Good	Slight	Needed; use tile drains.	Suitable; adequate drainage required before soil can be irrigated.	Not suitable.	

TABLE 11.—*Suitability of the soils of Scott County, Minn., for use in various*

Soil	Suitability as source of—			Susceptibility to frost action[3]	Base needed for flexible pavement[3]	Use for foundations[3]	Use for embankments[3]
	Topdressing for cuts, fills, embankments, etc.[1]	Sand and gravel	Material in upper part of roadway[2]				
Zimmerman (ZaA, ZaA2, ZaB, ZaB2, ZaC2).	Not suitable	Suitable for poorly graded fine sands.	Fair	Slight	Thin	Fair to good; permeability moderate to high; seepage control necessary; cutoffs not practical; piping hazard.	Fair; moderate strength and stability.

[1] Refers to surface soil as described in section Soils of Scott County.
[2] Refers to entire soil material unless layers are specified.
[3] Refers to substrata or till unless otherwise noted.
[4] Refer to table 4 for engineering specifications.
[5] See Irrigation and Drainage in section, Use and Management of Soils.

TABLE 12.—*Classification of soils by American*

General classification	Granular materials (35 percent or less passing No. 200 sieve)				
Group classification	A–1		A–3	A–2	
	A–1–a	A–1–b		A–2–4	A–2–5
Sieve analysis: Percent passing—					
No. 10	50 maximum.				
No. 40	30 maximum.	50 maximum.	51 minimum.		
No. 200	15 maximum.	25 maximum.	10 maximum.	35 maximum.	35 maximum.
Characteristics of fraction passing No. 40 sieve:					
Liquid limit			NP[2]	40 maximum.	41 minimum.
Plasticity index	6 maximum.	6 maximum.	NP	10 maximum.	10 maximum.
Group index	0	0	0	0	0
Usual types of significant constituent materials.	Stone fragments, gravel, and sand.	Stone fragments, gravel, and sand.	Fine sand.	Silty gravel and sand.	Silty gravel and sand.
General rating as subgrade	Excellent to good				

[1] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (pt. 1; ed. 7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, A.A.S.H.O. Designation: M 145–49.
[2] NP = nonplastic.
[3] Plasticity index of A–7–5 subgroup is equal to or less than LL minus 30. Plasticity index of A–7–6 subgroup is greater than LL minus 30.

kinds of construction, and selected characteristics affecting construction—Continued

Use for dikes[3]	Compaction characteristics at or near optimum moisture[3]	Water impoundment	Erosion of cuts or fills	Drainage for agriculture[4]	Sprinkler irrigation[5]	Terracing	Remarks
Fair with side slopes of 4 or 6 to 1.	Poor to fair; compact with pneumatic roller.	Not suitable	Severe	Not needed	Suitable	Not suitable	Suitable for septic tank disposal field.

Association of State Highway Officials[1]

Granular materials—Continued (35 percent or less passing No. 200 sieve)		Silt-clay materials (more than 35 percent passing No. 200 sieve)				
A–2—Continued		A–4	A–5	A–6	A–7	
A–2–6	A–2–7				A–7–5	A–7–6
35 maximum.	35 maximum.	36 minimum.	36 minimum.	36 minimum.	36 minimum.	36 minimum.
40 maximum. 11 minimum.	41 minimum. 11 minimum.	40 maximum. 10 maximum.	41 minimum. 10 maximum.	40 maximum. 11 minimum.	41 minimum. 11 minimum.[3]	41 minimum. 11 minimum.[3]
4 maximum.	4 maximum.	8 maximum.	12 maximum.	16 maximum.	20 maximum.	20 maximum.
Clayey gravel and sand.	Clayey gravel and sand.	Nonplastic to moderately plastic silty soils.	Highly elastic silts.	Medium plastic clays.	Highly plastic clays.	Highly plastic clays.
Fair to poor						

TABLE 13.—*Selected data from the Unified Soil Classification system*

[Based on information in The Unified Soil Classification System, Technical Memorandum No. 3–357 (2)]

Major divisions	Group symbol	Description
Coarse-grained soils (*more than half of material larger than No. 200 sieve size*):		
Gravels and gravelly soils (*more than half of coarse fraction is larger than No. 4 sieve size*).	GW	Well-graded gravels; gravel-sand mixtures; little or no fines.
	GP	Poorly graded gravels or gravel-sand mixtures; little or no fines.
	GM	Silty gravels; gravel-sand-silt mixtures.
	GC	Clayey gravels; gravel-sand-clay mixtures.
Sands and sandy soils (*more than half of coarse fraction is smaller than No. 4 sieve size*).	SW	Well-graded sands; gravelly sands; little or no fines.
	SP	Poorly graded sands or gravelly sands; little or no fines.
	SM	Silty sands; sand-silt mixtures.
	SC	Clayey sands; sand-clay mixtures.
Fine-grained soils (*more than half of material is smaller than No. 200 sieve size*):		
Silts and clays (*liquid limit less than 50*)	ML	Inorganic silts and very fine sands; rock flour; silty or clayey fine sands or clayey silts with slight plasticity.
	CL	Inorganic clays of low to medium plasticity; gravelly clays; sandy clays; silty clays, lean clays.
	OL	Organic silts and organic silty clays of low plasticity.
	MH	Inorganic silts; micaceous or diatomaceous fine sandy or silty soils; elastic silts.
Silts and clays (*liquid limit greater than 50*)	CH	Inorganic clays of high plasticity; fat clays.
	OH	Organic clays of medium to high plasticity; organic silts.
Highly organic soils	Pt	Peat and other highly organic soils.

Mechanical analyses.—Samples are analyzed in the laboratory to determine the percentage of particles of various sizes in the soil material (see table 9). The size and proportion of particles affect the behavior of material when it is used for engineering purposes. The mechanical analyses for the samples shown in table 9 were made by the combined sieve and hydrometer methods. The names for the various sizes of sand, silt, and clay used by engineers are not equivalent to the names used by agricultural soil scientists. To soil scientists, for example, "clay" refers to mineral grains less than 0.002 millimeters in diameter, whereas engineers usually define "clay" as being less than 0.005 millimeters in diameter.

Permeability.—The flow of water in soil layers is called permeability. It is a factor to be considered in several kinds of construction, including the building of irrigation systems. Table 10 gives permeability, in tentative ranges, for the soils mapped.

Available water.—The amount of water available to plants that is held in a soil after a good rain or thorough irrigation is referred to as *"available water,* or *water-holding capacity."* It is the amount of water in excess of the wilting coefficient held in a soil against the force of gravity. Available water, expressed in terms of inches per inch of soil material, is given in table 10.

Special Engineering Problems

Position of the water table (see table 10) and drainage characteristics affect the use of soils for engineering. Some soils that have a high water table can be made more suitable as a source of borrow material, as well as for roadway excavation, by building drainage ditches before earthwork is started. Underdrains may be required where either a perched or normal water table might cause unstable soil conditions.

Extensive areas of poorly and very poorly drained soils are in the depressions, and highly organic material has accumulated in some of these areas. Peat and muck have accumulated in some areas to depths varying from 2 to 10 feet or more. Peat has low strength and is in areas where the water table is normally high. Peat is therefore not suitable for use in foundations of roads or other engineering structures. Roads normally should be located to avoid areas of deep peat. Other soils have highly organic surface layers. Peat or highly organic material should be removed from the roadway section or foundation of the structure and placed where it will not be detrimental. Where the organic material is removed, it should be replaced by suitable soil material. Roads should be built on embankments in these depressed areas so that the pavement surface is at least 4 feet above the water table. A thorough field investigation should be made in depressed areas.

Parts of the bottom lands may be flooded each year. A continuous embankment may be needed in order to build the roadways in the lowlands above high water level. Suitable materials for use in the embankments may be taken from most areas of bottom land except the Oshawa and Rauville soils and possibly Dorchester silty clay loam.

Frost action, one of the primary soil-engineering problems in the county, is rated in table 11 for the various soils mapped. Although it might be desirable to suspend earthwork operations during winter to prevent use of frozen materials for constructing embankments, it is not always economically feasible to do so. Earthwork in gravelly or sandy materials that do not contain more than a small percentage of silt and clay

can be permitted during winter, provided the required standards for compaction of the soils and for exclusion of frozen materials are maintained.

To be nonsusceptible to damaging frost action, not more than 10 percent of the soil material should pass the No. 200 sieve. Soils having a high percentage of silts or very fine sands are more susceptible to damaging frost action—frost heaving and subsequent frost boils—than soils containing a mixture of clay, silt, and coarse materials.

Some deposits of glacial till contain lenses or pockets of fine sand and silt that are susceptible to differential frost heave. In places where these materials occur, a sufficiently thick layer of material not susceptible to heaving should be used in the highway subgrade. Uniformity of soils is stressed in grading design to cope with the frost problem.

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Glossary

Aggregate (of soil). Many fine soil particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alkaline soil. A soil that is alkaline throughout most or all of the parts occupied by plant roots. Precisely, any soil horizon having a pH greater than 7.0; practically, a soil having a pH above 7.3.

Alluvium. Sand, mud, and other sediments deposited on land by streams.

Alluvial soils. A great group of soils of the azonal order. These soils are forming in material recently deposited by water. The soil-forming processes have modified this material little or none; consequently, the soils have little profile development.

Association, soil. A group of defined and named soil units that occur in an individual geographic pattern. The soils in an association may be derived from the same kind of parent material and be similar in characteristics, or they may be derived from different kinds of parent material and be dissimilar in characteristics.

Azonal soils. A general group of soils having little or no soil profile development. Most of them are young. In the United States, the azonal soils are members of the Alluvial, Lithosol, and Regosol great soil groups.

Bedrock. The solid rock that underlies soils and other surface formations.

Bog soils. Soils of the intrazonal order that have mucky or peaty surface soils underlain by peat. Soils of this order normally have swamp or marsh vegetation and occur most often in humid regions.

Calcareous soil. A soil containing calcium carbonate, often mixed with magnesium carbonate, in such quantity as to effervesce visibly when dilute hydrochloric acid is applied. A calcareous soil has an alkaline reaction. *See* Reaction, soil.

Calcification. A general term for the soil-forming processes that keep enough calcium in the surface layer to saturate the soil colloids with exchangeable calcium to such extent that the colloids are rendered almost immobile and almost neutral in reaction. The processes are best observed in Chernozems and other soils having a horizon in which calcium carbonate accumulates.

Catena, soil. A group of soils, within a specific soil zone, that have developed from similar parent material but are unlike in characteristics because of differences in relief or drainage.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeters in diameter. As a soil textural class, soil material that contains 40 percent or more of clay, less than 45 percent of sand, and less than 40 percent of silt.

Climate (continental). A general term for the climate typical of great land masses; that is, wide ranges in temperature and precipitation because of distance from the sea or other moderating influences.

Colluvium. Mixed deposits of soil material and rock fragments near the base of rather steep slopes. The deposits have accumulated through soil creep, slides, and local wash.

Complex, soil. An intricate mixture of tiny areas of different kinds of soil. The areas are too small to be shown separately on a publishable map; therefore, the whole group of soils is shown together as a mapping unit and the pattern of the soils is described.

Consistence, soil. Cohesiveness or resistance to forces that tend to disrupt a soil aggregate. The relative mutual attraction of the particles in the soil mass, or their resistance to separation. Consistence is described by such terms as *loose or open, slightly, moderately, or very compact; mellow; friable; crumbly; plastic; sticky; soft; firm; hard;* and *cemented.*

Crust. The hard, brittle layer that forms on many soils when they dry.

Drift. Any kind of rock material that has been deposited in one place after having been removed from another. Glacial drift is a deposit of earth, sand, gravel, and boulders transmitted by glaciers. The term "glacial drift" covers both *glacial till,* which is not stratified, and *glacial outwash,* which is stratified.

Duff. The matted, partly decomposed organic surface layer of forested soils.

Erosion, soil. The removal of soil material by wind and running water. Technically, the term "erosion" refers to the wearing away of soils by geologic processes, and the term "accelerated erosion" refers to the loss of soil materials brought about through the activities of man. The term "erosion" is often used loosely to mean accelerated erosion.

First bottom. The normal flood plain of a stream that may be subject to frequent or infrequent overflow.

Friable. Easily crumbled in the fingers; nonplastic.

Gleization. The process of soil formation leading to development of a gley horizon in the lower part of the solum. A gley horizon is ordinarily bluish gray or olive gray, more or less sticky, compact, and often structureless. It develops because of waterlogging and lack of oxygen. The gleization process is important in the formation of soils of the Humic Gley and Bog great soil groups in this county.

Gray-Brown Podzolic soils. A zonal group of soils having thin organic coverings and thin organic-mineral layers over Grayish-brown leached layers. The leached layers rest upon brown B horizons that are richer in clay than the horizons above. These soils have formed under deciduous forests in a moist temperate climate.

Great soil group. Any one of several broad groups of soils that have fundamental characteristics in common.

Glauconite. An amorphous (without definite structure) silicate of iron and potassium that may contain considerable aluminum.

Horizon, soil. A layer of soil, approximately parallel to the soil surface, that has distinct characteristics produced by soil-forming processes.

Humic Gley. Intrazonal soils with a dark-brown or black surface layer, which at depths of 6 to 30 inches, grades to a grayish layer. Soils of this great soil group have developed under grasses and sedges, mostly in a humid or subhumid climate. *See* Gleization.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Intrazonal soils. Any one of the great groups of soils having more or less well-developed soil characteristics that reflect a dominating influence of some local factor of relief or parent material over the normal influences of climate and vegetation.

Kame. A short ridge, hill, or hillock of stratified drift. Most kames are interspersed with depressions, called kettles, that have no surface drainage.

Leaching. The removal of materials in solution by percolating waters.

Mapping unit. Any soil, miscellaneous land type, soil complex, or undifferentiated soil group shown on the detailed soil map and identified by a letter symbol.

Mineral soil. Any soil composed chiefly of mineral matter.

Mottled (or Mottling). Irregularly marked with spots of different colors.

Muck. Fairly well decomposed organic soil material that is relatively high in mineral content and dark in color. Muck accumulates under conditions of impaired drainage.

Nutrients, plant. Any element taken in by a plant and used for the elaboration of its food and tissue. From the air and water, plants take in carbon, hydrogen, and oxygen. From the soil, plants take nitrogen, phosphorus, calcium, potassium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements.

Order, soil. The highest category in soil classification. The three orders are zonal soils, intrazonal soils, and azonal soils.

Organic soil. A soil that consists primarily of organic matter; for example, peat soils, muck soils.

Parent material. The unconsolidated mass from which the soil profile develops.

Peat. Unconsolidated soil material consisting largely of undecomposed or slightly decomposed organic matter that accumulated under conditions of excessive moisture.

Phase, soil. A subdivision of the soil type made on the basis of variations in the soil type not significant to the classification of the type in its natural landscape, but significant in use and management. For example, a soil type may be divided into phases because of differences in slope, stoniness, or thickness.

Plastic. Capable of being molded or modeled without rupture; not friable.

Podzol soils. A great soil group of the zonal order. They have an organic mat and very thin organic-mineral layer above a gray leached layer, which rests upon an illuvial dark-brown horizon. Iron oxide and alumina, and sometimes organic matter, have been removed from the A horizon and deposited in the B. These soils developed under a coniferous or mixed forest, or under heath vegetation, in a temperate to cold moist climate. *See* Podzolization, Leaching, Zonal soil.

Podzolic soils. Soils that have been formed wholly or partly under the influence of the podzolization process. *See* Podzolization.

Podzolization. The process by which soils are depleted of bases, become more acid, and develop leached surface layers from which clay has been removed.

Prairie (Brunizem) soils. A zonal group of soils having dark-colored surface horizons grading through brown soil material to lighter colored parent material at 2 to 5 feet. These soils formed under tall grasses in a temperate, humid climate. The term has a restricted meaning in soil science and does not apply to all soils developed in treeless landscapes.

Productivity, soil. The present capability of a soil for producing a special plant or sequence of plants under a defined set of management practices.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of the soil mass expressed in pH values or in words as follows:

	pH		pH
Extremely acid	below 4.5	Neutral	6.6-7.3
Very strongly acid	4.5-5.0	Mildly alkaline	7.4-7.8
Strongly acid	5.1-5.5	Moderately alkaline	7.9-8.4
Medium acid	5.6-6.0	Strongly alkaline	8.5-9.0
Slightly acid	6.1-6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Usually sand grains consist chiefly of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more of sand and not more than 10 percent of clay.

Series, soil. A group of soils that, except for the texture of their surface soil, are similar in profile characteristics and in horizon arrangement. The soils of one series have developed from a particular type of parent material. A series may include two or more soil types, which differ primarily in texture of the surface soil.

Silt. (1) Individual mineral particles of soil that range in diameter between the upper size of clay, 0.002 millimeter, and the lower size of very fine sand, 0.05 millimeter. (2) Soil of the textural class called silt contains 80 percent or more of silt and less than 12 percent of clay. (3) Sediments deposited from water in which the individual grains are approximately of the size of silt, although the term is sometimes applied loosely to sediments containing considerable sand and clay.

Soil. The natural medium for the growth of land plants. A soil is a natural three-dimensional body on the surface of the earth, unlike the adjoining bodies.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soils includes the A and B horizons. Usually the characteristics of the material in these horizons are quite unlike those of the underlying parent material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geological materials. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from the adjoining aggregates. The principal forms of soil structure are *platy, prismatic, columnar, blocky,* and *granular.* Structure is defined in terms of distinctness, size, and shape of the soil aggregates. For example, "moderate medium subangular blocky" means moderately distinct, medium-sized aggregates of subangular blocky shape.

Subsoil. That part of the solum below plow depth. *See* Solum.

Surface soil. That part of the soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness.

Terrace. (1) *Agricultural:* A broad channel or embankment constructed across sloping lands, at or approximately on a contour line. Terraces are spaced at regular intervals on the slope so as to intercept and control runoff. They check runoff so that more water will infiltrate, and they carry the surplus water to an outlet at a velocity that will not erode the soil.

(2) *Geologic:* A flat or undulating plain, commonly rather narrow and usually with a steep front, that borders a river, lake, or the sea. Many streams are bordered by a series of terraces at different levels. The various levels indicate the location of the flood plains during successive periods. Many older terraces have become more or less hilly through stream dissection, but they are still regarded as terraces.

Texture, soil. The relative proportions of the various size groups of individual soil grains in a mass of soil; specifically, the proportions of sand, silt, and clay. The soil texture classes, in increasing order of the content of the finer separates, are as follows: *Sand, loamy sand, sandy loam, loam, silt loam,* and *clay.* These classes may be modified according to relative size of the coarser particles; for example *fine sand, loamy fine sand, fine sandy loam, very fine sandy loam, coarse sandy loam, gravelly sandy loam, gravelly loam, cobbly loam, sandy clay, stony clay,* and *stony loam.*

Till plain. A level or undulating land surface covered by glacial till.

Tilth, soil. The physical condition of a soil in respect to its fitness for the growth of a specified plant or sequence of plants.

Topsoil. A general term used in at least four different senses: (1) A presumed fertile soil material, usually rich in organic matter, used to topdress roadbanks, lawns, and gardens; (2) the plow layer of a soil, and thus a synonym for surface soil; (3) the original or present dark-colored upper soil, which ranges from a mere fraction of an inch to 2 or 3 feet deep in different kinds of soil; and (4) the original or present A horizon, varying widely among the different soils. If applied to soils in the field, the term has no precise meaning unless defined as to depth or productivity in relation to a specific kind of soil.

Transitional soil. A soil that does not clearly belong to any important soil group or series with which it is associated, but which has some properties of each.

Transported soil materials. Parent materials of soils that have been moved from their place of origin and redeposited during the weathering process or some part of the process.

Type, soil. A category under the soil series based on the texture of the surface soil. A soil type is a group of soils having horizons similar in differentiating characteristics and arrangement in the soil profile and developed from a particular type of parent material. The name of a soil type consists of the name of the soil series plus the textural class name of the upper part of the soil that is equivalent to the surface soil. Thus, Dundas silt loam is the name of a soil type within the Dundas series.

Water table. The upper limit of the part of the soil or underlying rock material that is wholly saturated with water.

Zonal soils. Soils having well-developed characteristics that reflect the influence of the active factors of soil formation. The active factors are climate and living organisms, chiefly vegetation.

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