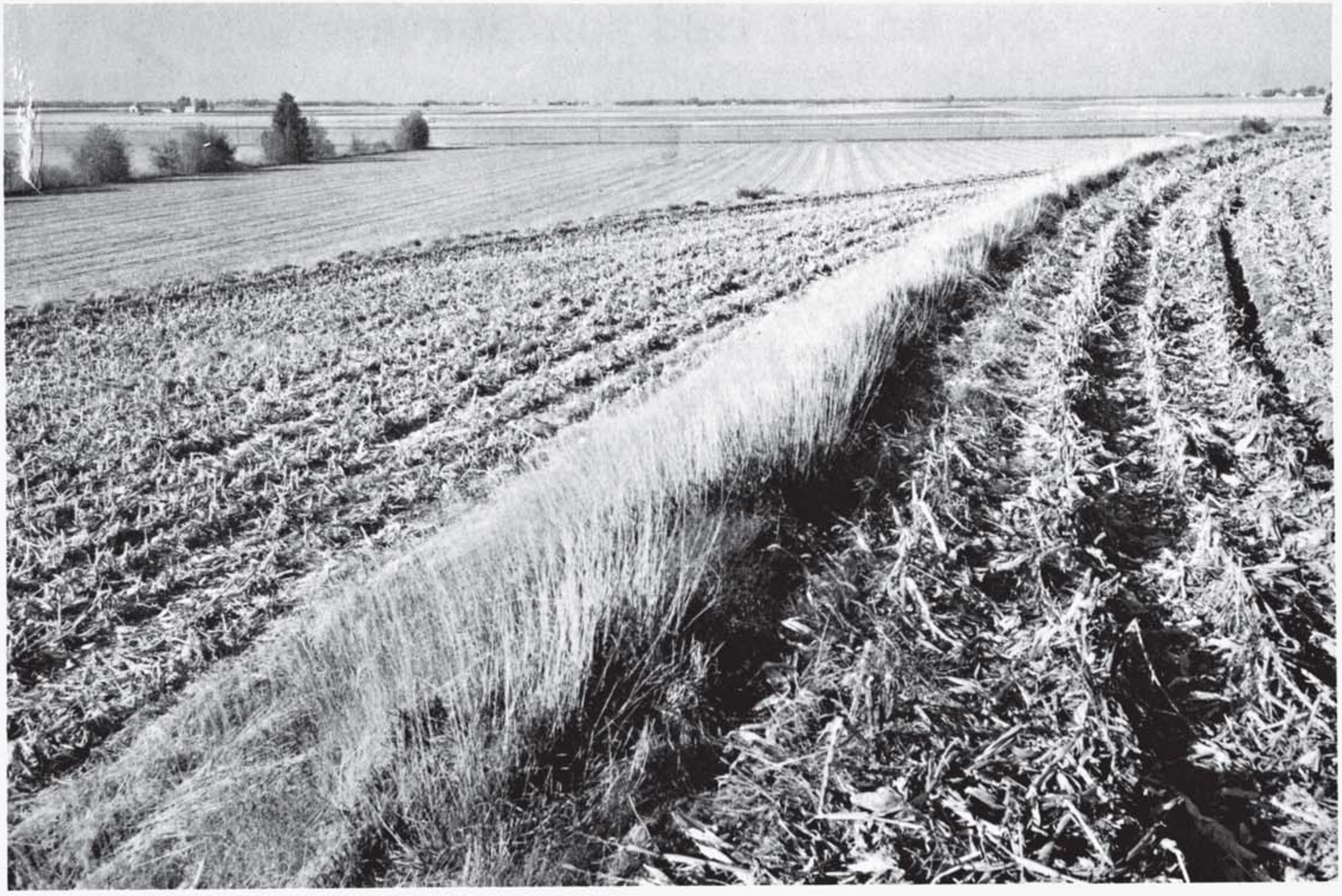
SOIL SURVEY OF

Logan County, Illinois



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Illinois Agricultural Experiment Station

Issued May 1974

Major fieldwork for this soil survey was done in the period 1960–67. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1967. This survey was made cooperatively by the Soil Conservation Service and the Illinois Agricultural Experiment Station. It is part of the technical assistance furnished to the Logan County Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250. Illinois Agricultural Experiment Station Soil Report No. 92.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodland; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Logan County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the survey. This guide lists all the soils of the county in numerical order by map symbol. It shows the page where each soil is described and the page for the management group. It also gives the recreational group in which each soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the management groups.

Foresters and others can refer to the section "Woodland." This section discusses the extent of the woodlands in the past and the present and gives estimates on productivity.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Recreation specialists will find pertinent information in the section "Recreational Uses of the Soils."

Local planning boards will find valuable information about the location, extent, and limitations of soils for various rural and urban uses in the sections "Recreational Uses of the Soils" and "Engineering Uses of the Soils."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain estimates of soil properties and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation, Morphology, and Classification of Soils."

Newcomers in Logan County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication.

Cover: **View of the Ipava-Sable-Tama soil association near Elkhart. Parallel terraces control erosion on Tama soils in the foreground. Nearly level Ipava and Sable soils are in the background.**

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SOIL SURVEY OF LOGAN COUNTY, ILLINOIS

BY G. W. HUDELSON, SOIL SCIENTIST, SOIL CONSERVATION SERVICE

FIELDWORK BY G. W. HUDELSON, IN CHARGE, N. E. BARNES, R. E. BOURLAND, D. R. MAPES, AND J. A. THOMPSON, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH ILLINOIS AGRICULTURAL EXPERIMENT STATION

LOGAN COUNTY is in the central part of Illinois (fig. 1). The county occupies about 398,080 acres, or 622 square miles. Lincoln, the county seat, is the largest city. It is about 30 miles from Springfield, 150 miles from Rockford, 150 miles from Chicago, and 115 miles from East St. Louis.

General Nature of the County

This section discusses the physiography and drainage, climate, history, transportation, industry, and farming of the county. It should be useful to those who are not familiar with the county.

Physiography and Drainage

Nearly all of Logan County is in the Springfield Plain, but the northeastern part is in the Bloomington Ridged Plain (*5*).[1] Broad, nearly level areas are common in the county. Sloping areas occur along the natural drainageways. Remnants of the Buffalo Hart moraine of Illinoian-age glaciation are conspicuous in the southwestern and western parts of the county. These morainal remnants are a series of small knolls, hills, and ridges. Elkhart Hill is an example. It is also the highest point in the county and is about 777 feet above sea level.

The Bloomington Ridged Plain area of the northeastern part of the county includes the Shelbyville and Leroy moraines of Late Wisconsinan-age glaciation. The Shelbyville moraine represents the farthest advance of the Late Wisconsinan-age ice from the northeast into the county. Change in the topography is noticeable in this part of the county, which is more rolling than the other parts and has only a few nearly level areas. More detailed information about relief in specific parts of the county is given in the section "General Soil Map."

Natural drainage of the county is westward. The main stream is Salt Creek with its tributaries—Prairie, Sugar,

[1] Italicized numbers in parentheses refer to Literature Cited, page 97.

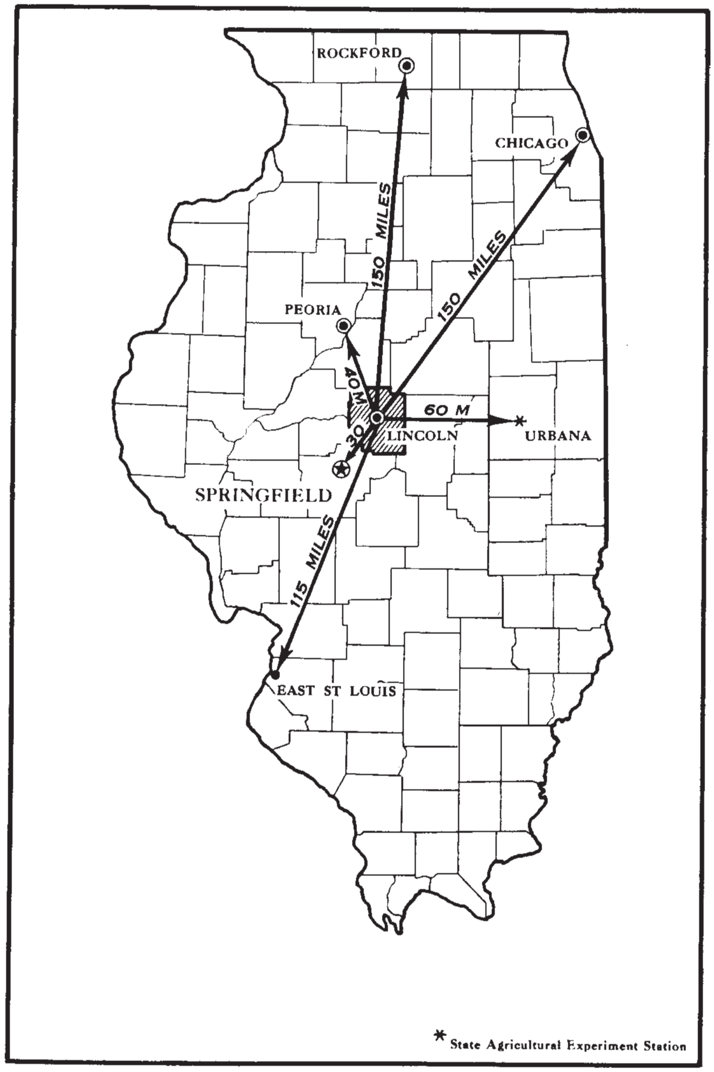

Figure 1.—Location of Logan County in Illinois.

Kickapoo, Deer, and Lake Fork Creeks. Most streams have low gradients and occupy alluviated and terraced valleys.

Climate [2]

Logan County has the continental climate typical of central Illinois. The temperature ranges widely throughout the year. The average annual range is 108° F. In most summers the temperature rises to near 100°, and in most winters it falls to −5° to −10°. Storm centers and associated weather fronts bring frequent changes in temperature, humidity, cloudiness, and wind direction during much of the year. Such changes are less frequent in summer.

Table 1 gives temperature and precipitation data for the county. In table 2 are shown the probabilities of the last freezing temperatures in spring and the first in fall. Table 3 gives figures that indicate, for the period March 1 through November 21, the chances of receiving specified amounts of precipitation during 1-week and 2-week periods.

Annual precipitation averages about 36 inches and has varied from a low near 24 inches to a high near 46 inches. Monthly precipitation averages near 4 inches for April through June. The average is only about 2 inches per month for the normally driest months of December through February. In recent years there has been an annual average of about 70 days with precipitation of one-tenth inch or more and 20 to 25 days with one-half inch or more.

[2] By WILLIAM L. DENMARK, climatologist for Illinois, National Weather Service, U.S. Department of Commerce.

Normal rainfall in July and August is insufficient to meet the demands of a vigorously growing field crop. Subsoil moisture must be stored during the previous fall and winter for best crop growth during most seasons. Major droughts are infrequent, but prolonged dry periods are not unusual during part of the growing season. These dry periods usually reduce potential crop yields.

Summer precipitation occurs mostly as showers or thunderstorms of brief duration. A single thunderstorm often produces in excess of an inch of rain and is occasionally accompanied by hail and damaging winds. Nearly 5 inches of rain has fallen within a 24-hour period and more than 14 inches during a month. Some fall and winter months have had less than one-fourth inch of precipitation.

Growing field crops are most likely to be damaged if hail falls during the months of June, July, and August. There has been an average of less than three hail-producing thunderstorms per year in the same location, and less than one in 2 years during the critical growing period (*3*). Not all hailstorms have stones of sufficient size or quantity to produce extensive crop damage.

Summers are warm, but continuous warm periods are seldom prolonged. Temperatures reach 100° or higher during about half of the summers. Temperatures of 90° or higher occur on about one-third of the days during an average July or August, and the average is less than 50 such days annually.

January is normally the coldest month. February often has days as cold as January, but February cold periods are usually of shorter duration. The record low temperature of −34° occurred on January 15, 1929. The temperature falls to zero or below almost every winter. Days with temperatures of 32° or lower average about 130 annually.

TABLE 1.—*Temperature and precipitation data for Logan County, Illinois*

[Data from records at Lincoln, Illinois]

Month	Temperature				Precipitation			
	Average daily maximum	Average daily minimum	2 years in 10 will have at least 4 days with— Maximum temperature equal to or higher than—	2 years in 10 will have at least 4 days with— Minimum temperature equal to or lower than—	Average total	1 year in 10 will have— Less than—	1 year in 10 will have— More than—	Days with snow cover of 1 inch or more
	°F.	*°F.*	*°F.*	*°F.*	*Inches*	*Inches*	*Inches*	*Number*
January	37	20	53	−7	2.0	0.7	3.3	12
February	40	22	56	−2	2.0	1.1	2.4	8
March	50	30	68	13	2.9	1.5	4.5	5
April	64	41	83	29	3.8	2.4	9.9	(1)
May	75	52	90	34	4.0	1.5	5.4	0
June	85	62	95	49	4.5	1.4	7.3	0
July	90	65	96	54	3.3	2.0	5.8	0
August	88	63	96	51	3.1	1.6	6.6	0
September	80	55	93	38	3.0	1.1	6.6	0
October	69	44	85	29	2.8	.5	3.7	0
November	51	32	72	13	2.4	1.7	3.1	1
December	39	23	58	−5	2.1	.5	3.0	8
Year	64	42	(2) 101	(3) −8	35.8	30.2	44.5	34

(1) Less than one-half day.
(2) Average annual maximum.
(3) Average annual minimum.

TABLE 2.—*Probabilities of last freezing temperature in spring and first in fall (4)*

[All freeze data are based on temperatures in a standard National Weather Service thermometer shelter at a height of approximately 5 feet above the ground and in a representative exposure. Lower temperatures will exist at times nearer the ground and in local areas subject to extreme air drainage]

Probability	Dates for given probability and temperature				
	32° F.	28° F.	24° F.	20° F.	16° F.
Last in spring:					
Average date	April 27	April 12	March 29	March 17	March 7
25 percent chance after	May 6	April 21	April 7	March 26	March 16
10 percent chance after	May 14	April 29	April 15	April 3	March 24
First in fall:					
Average date	October 13	October 26	November 6	November 15	November 28
25 percent chance before	October 4	October 17	October 28	November 6	November 19
10 percent chance before	September 27	October 10	October 21	October 30	November 12

TABLE 3.—*Chances of receiving a specified amount of precipitation during a specified period in Logan County, Ill. (2)*

Period	During a 1-week period				During a 2-week period		
	Trace or less	0.4 inch or more	1 inch or more	2 inches or more	Trace or less	1 inch or more	2 inches or more
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
March 1–7	9	42	14	3	2	51	20
March 8–14	6	56	28	9			
March 15–21	11	59	25	5	0	60	25
March 22–28	8	59	28	8			
March 29–April 4	8	53	27	9	2	65	32
April 5–11	2	66	35	12			
April 12–18	6	55	25	7	0	59	28
April 19–25	9	64	32	9			
April 26–May 2	9	64	31	8	0	64	29
May 3–9	8	54	27	9			
May 10–16	8	58	32	12	0	64	35
May 17–23	11	59	34	14			
May 24–30	4	61	33	13	0	66	37
May 31–June 6	7	61	35	13			
June 7–13	9	66	38	14	2	64	34
June 14–20	19	51	27	14			
June 21–27	4	63	37	10	0	64	35
June 28–July 4	15	54	29	16			
July 5–11	19	52	30	10	2	55	27
July 12–18	17	47	24	12			
July 19–25	22	45	22	8	4	43	19
July 26–August 1	20	39	19	7			
August 2–8	17	52	27	7	4	54	28
August 9–15	11	55	29	10			
August 16–22	13	51	26	10	4	48	20
August 23–29	19	43	17	4			
August 30–September 5	19	46	26	10	4	51	27
September 6–12	13	57	29	9			
September 13–19	24	49	24	7	2	50	23
September 20–26	11	52	26	9			
September 27–October 3	24	50	31	14	8	56	30
October 4–10	17	49	25	9			
October 11–17	22	44	17	4	9	40	16
October 18–24	30	40	19	6			
October 25–31	16	43	18	4	6	43	18
November 1–7	22	45	22	7			
November 8–14	20	43	19	5	6	38	15
November 15–21	20	39	16	4			

The number of days between the average date of the last freezing temperature (32° or below) in spring and the average date of the first freezing temperature in fall has been termed the growing season. The growing season is approximately 168 days in Logan County. The growing season designation is misleading because different crops have different temperatures at which growth is affected. Table 2 indicates the probability of occurrence of several different threshold temperatures. Temperatures often vary considerably between ridge and valley locations during radiation freezes, the type most common in Illinois.

The information in table 3 applies to much of Logan County, though there are some local variations. The probabilities listed should be used only to show the seasonal pattern of expected amounts of rainfall. A probability that contrasts with those of immediately adjacent periods is likely to be unreliable for planning a specific operation.

History

The territory from which Logan County was established was first settled around 1819. It was originally part of St. Clair and Knox Counties. These counties were then divided into other counties, and part of what is now Logan County was included with Sangamon County. Logan County was established in 1839, but its territory did not include present-day Prairie Creek, Orvil, Eminence, or Atlanta Townships. These townships were added soon thereafter to make up the present area of the county.

Logan County is about 24 miles in width (east and west) and about 28 miles in extreme length (north and south). As in the early history of many counties, the county seat was moved several times. In 1839 it was at Postville; it was moved to Mt. Pulaski in 1847 and established finally at Lincoln in 1853.

Transportation

The coming of the railroad in 1853 opened the county to further settlement and development. Today, lines of the Gulf, Mobile, and Ohio; the Illinois Central; the Illinois Terminal; and the Penn Central railroads serve the communities of the county. U.S. Highway No. 66, to Chicago and St. Louis, is the main highway crossing the county. Other highways are U.S. Highway No. 54 and State Routes Nos. 10 and 121. With the exception of U.S. Highway No. 54, these highways pass through Lincoln, the county seat, and spread out across the county like the spokes in a wheel. All farms have access to surfaced roads. Logan County Airport provides transient, charter, freight, passenger, and mechanical services. Bus transportation is available on the main highways. Motor freight lines serve every trading center in the county.

Industry

Although Logan County is mainly agricultural, it has several industries centered around Lincoln. The largest single employer is the Lincoln State School for the mentally retarded. Products produced by the major industries include bottles and window glass, corrugated boxes, store fixtures, cosmetics, ladies dresses, and electrical switches. Small industries and businesses that support farming are throughout the county.

Farming

According to statistics of the Illinois Co-operative Crop Reporting Service, there were 151,900 acres of corn in Logan County in 1965, compared with 127,900 acres in 1945. Soybean acreage in 1945 was at a high of 103,500 acres, but in 1950 declined to around 71,300 acres. By 1965, soybean acreage had increased to 100,900 acres. Oats have declined steadily from 47,400 acres in 1945 to 11,400 acres in 1965. Wheat acreage remained between 23,000 to 25,000 acres from 1950 to 1964, but declined in 1965 to about 19,300 acres. Hay crops in 1945 were at a low of 21,800 acres, but increased to about 33,900 acres by 1950. By 1965, the acreage of hay crops had declined to 23,200 acres.

Statistics of the Illinois Co-operative Crop Reporting Service show that in 1950 the number of beef cattle was 4,400, but the number increased to around 10,900 by 1965. Milk cows, which include all cows and heifers 2 years old and older, numbered 8,600 in 1945 and have declined steadily to about 2,300 in 1965. The number of hogs was 60,500 in 1945, 61,400 in 1959, 57,400 in 1963, and 53,600 in 1965. The number of stock sheep was 5,700 in 1945; it increased to a high of 9,000 in 1959 but decreased to around 6,700 in 1965. The number of chickens declined steadily from a high of 295,300 in 1945 to a low of 23,200 in 1965.

In 1964, according to the U.S. Census of Agriculture, about 95 percent of Logan County, or 379,683 acres, was in farms. Of the 1,411 farms in the county, 1,163 were cash-grain farms, 139 were livestock other than dairy and poultry farms, 19 were dairy farms, and the remaining were miscellaneous and unclassified, poultry, or general farms. The average farm was 269.1 acres in size, and this size has increased steadily in recent years. The number of farms between 140 and 179 acres in size has declined from 294 in 1959 to 207 in 1964. In 1964, 522 farms were between 260 and 499 acres in size. In 1959, the number of farms was almost the same. In 1959, 75 farms were between 500 and 999 acres in size. By 1964, the number had increased to 114.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Logan County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kind of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* (*8*) are the categories of soil classification most used in the local survey.

Soils that have profiles almost alike make up a soil series.

Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Clinton and Proctor, for example, are the names of two soil series. All the soils in the United States having the the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape. Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Clinton silt loam, 0 to 2 percent slopes, is one of several phases within the Clinton series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the soil boundaries on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or or different phases within one series. Two such kinds of mapping units are shown on the soil map of Logan County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that it is not practical to show them as separate units on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Birkbeck-Miami silt loams, 7 to 12 percent slopes, eroded, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Hickory and Sylvan soils, 15 to 50 percent slopes, eroded, is an example.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Logan County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, or building, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The eight soil associations in Logan County are discussed in the following pages.

1. Ipava-Sable-Tama association

Nearly level to strongly sloping, poorly drained to well drained soils that formed in more than 5 feet of loess; on uplands

This association typifies much of the county. Large areas are nearly level, but areas are sloping along natural drainageways, on small knolls, and on remnants of morainal ridges, which are common in some parts of the association (fig. 2).

This association makes up 58 percent of the county. About 33 percent of the association is Ipava soils, 33 percent is Sable soils, 25 percent is Tama soils, and the remaining 9 percent is minor soils.

The Ipava soils lie mainly in broad, irregular areas and on small rises that are commonly surrounded by areas of Sable soils. Ipava soils have slopes of 0 to 3 percent and are somewhat poorly drained. The surface layer is black silt loam about 16 inches thick. The subsoil, about 26 inches thick, is dark-brown silty clay loam mottled with light gray and yellowish brown. Below the subsoil is brownish-gray and yellowish-brown silt loam.

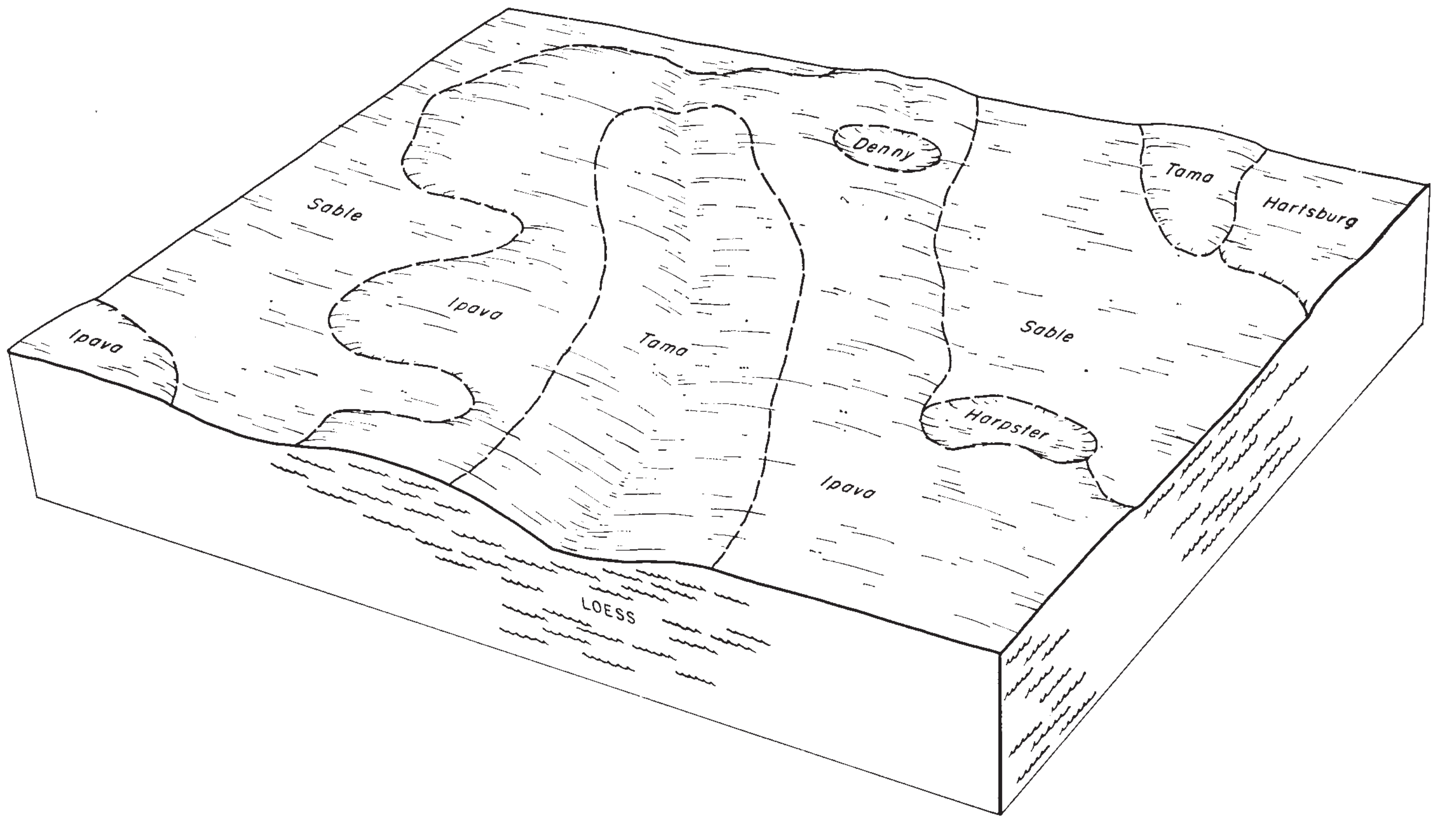

Figure 2.—**Relationship of soils to topography and underlying material in the Ipava-Sable-Tama association.**

The Sable soils lie in small drainageways, small depressions, and large flat areas. They have slopes of 0 to 2 percent and are poorly drained. The surface layer is black silty clay loam about 20 inches thick. The subsoil, about 31 inches thick, is gray silty clay loam mottled with yellowish brown. Below the subsoil is gray silt loam mottled with yellowish brown. These soils are wet, especially during the spring, but in most areas excess water is removed by surface drains and tile drains.

The Tama soils are mainly sloping, but in some areas they are nearly level. They have slopes of 9 to 12 percent and are well drained. The surface layer is very dark brown silt loam about 13 inches thick. The subsoil, about 40 inches thick, is dark yellowish-brown silty clay loam mottled with pale brown in the lower part. In some places mottling is absent. Below the subsoil is yellowish-brown silt loam mottled with pale brown.

Hartsburg, Harpster, and Denny are the minor soils in this association. Hartsburg and Harpster soils are similar to the Sable soils in color, texture, and natural drainage. Denny soils are poorly drained, lie in small depressions, and are distinctive in the landscape as gray spots among the darker colored soils.

This association is used primarily for cash-grain farming. Corn and soybeans are the main crops; other crops are small grains, grasses, and legumes. There are a few hog and cattle feeding operations and dairy enterprises. The soils in this association are highly productive if properly managed. Erosion is a hazard and wetness is a limitation in some places. Erosion control measures, tile drains, and shallow surface ditches are used to reduce soil losses and improve drainage.

2. *Broadwell-Lawndale-Dickinson-Onarga association*

Nearly level to strongly sloping, somewhat poorly drained to somewhat excessively drained soils that formed either in 3½ to 5 feet of loess and in the underlying sand, or entirely in sand; on uplands

A large part of this association is in the northwestern corner of the county. Another area extends from southwest of Chestervale to northeast of Beason in the east-central part of the county. Nearly level to strongly sloping areas are common, but in many places there are long, narrow ridges consisting of wind-deposited sand (fig. 3).

This association makes up about 8 percent of the county. About 53 percent of this association is Broadwell soils, 11 percent is Lawndale soils, 11 percent is Dickinson-Onarga soils, and the remaining 25 percent is minor soils.

The Broadwell soils have slopes of 0 to 12 percent and are well drained and moderately well drained. They have a very dark brown silt loam surface layer about 15 inches thick. The subsoil is dark yellowish-brown silty clay loam in the upper part and loamy sand in the lower part. Below the subsoil is yellowish-brown, loose sand.

The Lawndale soils have slopes of 0 to 3 percent and are somewhat poorly drained. The surface layer is black silt loam about 18 inches thick. The subsoil, about 34 inches thick, is mainly dark grayish brown and yellowish brown with light brownish-gray mottles. It is silty clay

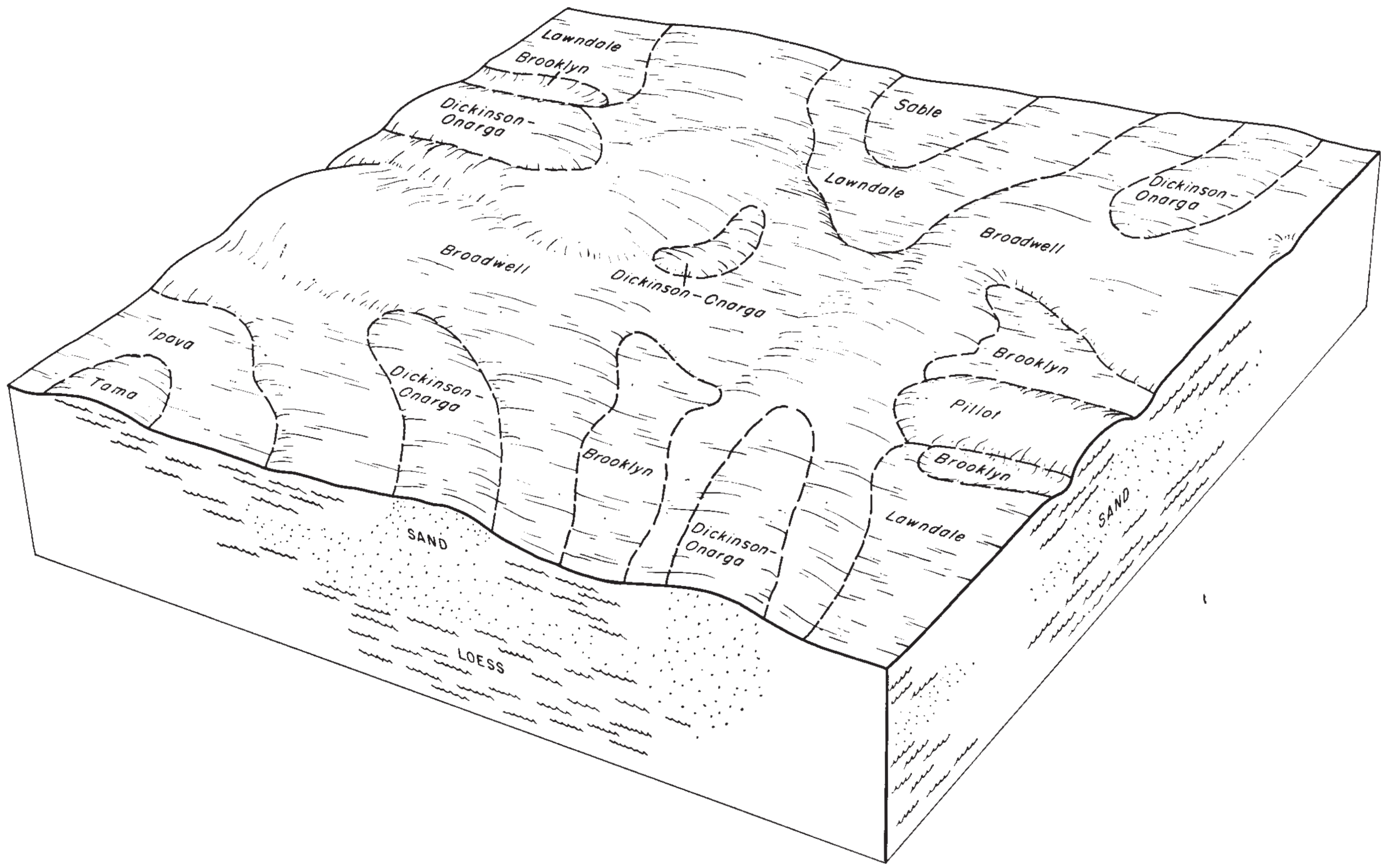

***Figure 3.*—Relationship of soils to topography and underlying material in the Broadwell-Lawndale-Dickinson-Onarga association.**

loam in the upper part and loamy sand in the lower part. Below the subsoil is yellowish-brown loose sand.

The Dickinson and Onarga soils occur in intricate patterns and were mapped in complexes. They have slopes of 0 to 15 percent and are somewhat excessively drained to moderately well drained. They have a very dark grayish-brown or very dark brown sandy loam surface layer 13 to 16 inches thick. The subsoil is dark yellowish brown and ranges from sandy loam to sandy clay loam. Dark yellowish-brown, loose sand is below the subsoil at a depth of less than 45 inches.

Minor soils in this association are the Sable, Pillot, Brooklyn, Tama, and Ipava soils. Sable and Brooklyn soils are poorly drained and are in depressions. Pillot and Tama soils are sloping and moderately well drained and well drained. Pillot soils have sand at shallow depths. Ipava soils are somewhat poorly drained and nearly level.

This association is used primarily for cash-grain farming. There are a few hog and cattle feeding operations and dairy enterprises. Corn and soybeans are the main crops; other crops grown are small grains, grasses, and legumes. Most of the soils are highly productive if properly managed. Erosion is a hazard and wetness is a limitation in some places. The sandy soils are droughty. Erosion control measures and practices that improve drainage are commonly needed, but in many areas the nearly level soils have few limitations.

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3. *Tama-Plano-Muscatine association*

Nearly level to moderately sloping, well-drained to somewhat poorly drained soils that formed in 3½ to more than 5 feet of loess or in silty water-laid material and stratified outwash; on terraces

This association is on the terraces along Salt, Sugar, Kickapoo, Deer, Lake Fork, and Prairie Creeks. Nearly level areas of soils predominate, but many long, narrow, channellike depressions are common in some places. Areas along terrace edges and small drainageways are sloping (fig. 4).

This association makes up about 11 percent of the county. About 23 percent of this association is Tama soils, 15 percent is Plano soils, 13 percent is Muscatine soils, 22 percent is Denny and Drummer soils, and the remaining 27 percent is minor soils.

The Tama soils in this association have slopes of 0 to 2 percent. They are well drained and formed in silty material that is more than 60 inches thick. The surface layer is very dark brown silt loam about 13 inches thick. The subsoil is dark yellowish-brown silty clay loam about 40 inches thick. In some places the lower part of the subsoil has pale-brown and yellowish-brown mottles. Yellowish-brown silt loam mottled with pale brown is beneath the subsoil. Sand and gravel are at depths greater than 5 feet.

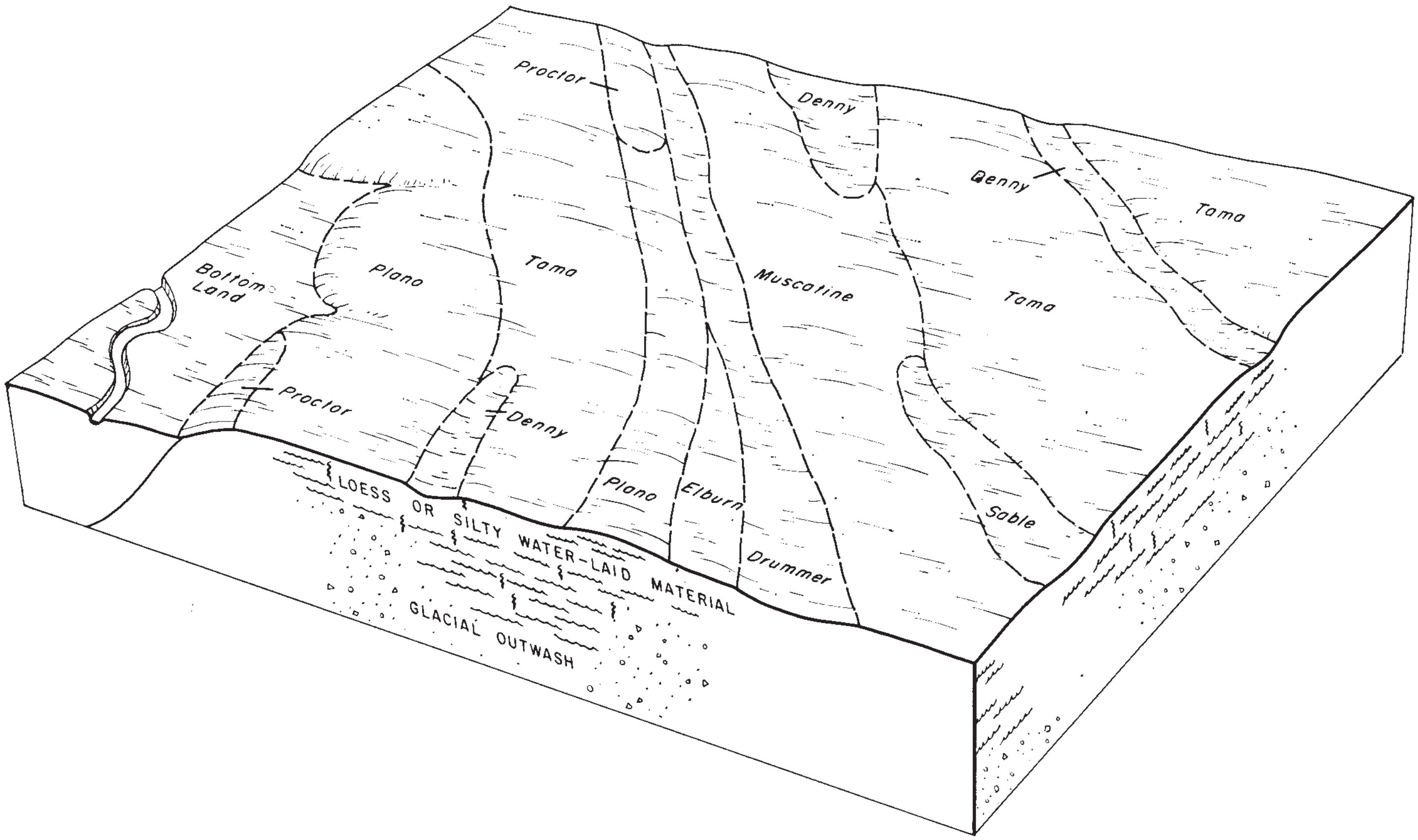

Figure 4.—**Relationship of soils to topography and underlying material in the Tama-Plano-Muscatine association.**

The Plano soils have slopes of 0 to 7 percent and are well drained and moderately well drained. They formed in loess or in silty water-laid material about 50 inches thick and the underlying stratified outwash. The surface layer is very dark grayish-brown silt loam about 12 inches thick. The subsoil, about 44 inches thick, is dark yellowish-brown silty clay loam in the upper and middle parts. It is loam and sandy loam in the lower part. Below the subsoil are thin layers of silt loam, sandy loam, loam and sand. Below a depth of about 5 feet, there is sand and gravel.

The Muscatine soils have slopes of 0 to 3 percent and are somewhat poorly drained. They formed in silty material that is more than 60 inches thick. The surface layer is black silt loam about 20 inches thick. The subsoil, about 26 inches thick, is dark-brown or brown silty clay loam mottled with grayish brown, gray, and yellowish brown. Below the subsoil is mixed gray and strong-brown silt loam. Sand and gravel are below a depth of about 5 feet.

Denny soils have slopes of less than 2 percent and are poorly drained. On terraces they occupy broader and shallower depressions than they do on the uplands. They formed in silty material more than 60 inches thick. The surface layer is very dark grayish-brown silt loam about 9 inches thick, and the subsurface layer is grayish-brown silt loam about 8 inches thick. The subsoil, about 34 inches thick, is dark grayish-brown silty clay mottled with yellowish brown in the upper part and is mixed light brownish-gray and yellowish-brown silty clay loam in the lower part. Below the subsoil is light brownish-gray silt loam, and below a depth of about 5 feet is sand and gravel. Denny soils are distinctly noticeable as gray areas in the association.

Drummer soils have slopes of less than 2 percent and are poorly drained. They formed in silty material about 40 to 60 inches thick and in the underlying stratified loamy outwash. They commonly occupy low, rather than high, terraces. The surface layer is black silty clay loam about 17 inches thick. The subsoil, about 37 inches thick, is silty clay loam in the upper and middle parts and loam in the lower part. It has a mixture of colors that include dark grayish brown, very dark gray, gray, olive brown, and yellowish brown. Underlying the subsoil are thin layers of loam, silt loam, sandy loam, and gravel.

Minor soils in this association are the Sable, Proctor, and Elburn soils. Sable soils are poorly drained and occupy depressional areas. The well drained and moderately well drained Proctor soils are nearly level and sloping. Somewhat poorly drained Elburn soils are nearly level.

This association is used primarily for cash-grain farming. Corn and soybeans are the main crops; other crops grown are small grains, grasses, and legumes. The soils are highly productive if properly managed. Wetness is a limitation and erosion is a hazard in some places. The better drained, nearly level soils have few restrictions. In some places erosion control measures and improved drainage are needed. The underlying outwash in areas of this association is a good source of sand and gravel. Where the material below the soils is porous, there is possible ground water contamination from onsite sewage disposal systems.

4. Tama-Catlin association

Gently sloping to strongly sloping, well drained and moderately well drained soils that formed either in 3½ to more than 5 feet of loess and glacial till, or entirely in loess; on uplands

This association is in the northeastern part of the county. It includes a large part of the glacial moraine area that lies in this part of the county, in a general northwest-southeast direction. The association is divided by many small drainageways that finger into large gently sloping areas (fig. 5).

This association makes up about 4 percent of the county. About 59 percent of this is Tama soils, 34 percent is Catlin soils, and the remaining 7 percent is minor soils.

The Tama soils in this association have slopes of 2 to 12 percent. They are well drained and formed in loess more than 60 inches thick. The surface layer is very dark brown silt loam about 13 inches thick. The subsoil, about 40 inches thick, is dark yellowish-brown silty clay loam that generally is mottled with pale brown in the lower part. In places mottling is absent. Below the subsoil is yellowish-brown silt loam mottled with pale brown.

The Catlin soils have slopes of 2 to 12 percent and are well drained and moderately well drained. They formed in loess 40 to 60 inches thick and in the underlying loamy glacial till. The surface layer is very dark grayish-brown silt loam about 10 inches thick. The subsoil, about 42 inches thick, is dark yellowish-brown silty clay loam in the upper part and yellowish-brown clay loam in the lower part. Below the subsoil is yellowish-brown and olive-brown loam.

Minor soils in this association are mainly Parr soils. They are well drained and formed primarily in loam glacial till. They commonly occupy small areas on side slopes of drainageways and on point slopes where two drainageways converge. These soils are eroded, and till pebbles and stones are common in the surface layer.

This association is used primarily for cash-grain farming. There are a few hog and cattle feeding operations and dairy enterprises. Corn and soybeans are the main crops; other crops grown are small grains, grasses, and legumes. The soils are highly productive if properly managed. Erosion is a hazard, but terraces, contouring, and grassed waterways are used to reduce soil losses.

5. Sawmill-Lawson association

Nearly level, poorly drained and somewhat poorly drained soils that formed in silt loam and silty clay loam sediments; on bottom lands

This association consists of soils on bottom lands along the creeks of the county. Predominantly the topography is nearly level, but in some places there are depressions and areas along overflow channels that are sloping (fig. 6).

Figure 5.—Typical landscape in association 4, southwest of Atlanta. Tama soils in the foreground and Catlin soils on steeper side slopes along the drainageway.

Figure 6.—**Typical landscape in association 5. Nearly level Lawson and Sawmill soils on the bottom land along Salt Creek a few miles south of Beason. Trees in background are on sloping Hickory soils of the uplands.**

This association makes up about 11 percent of the county. About 56 percent of this association is Sawmill soils, 22 percent is Lawson soils, and the remaining 22 percent is minor soils.

The Sawmill soils are poorly drained and occupy broad areas and long, narrow depressions. The surface layer is black silty clay loam about 27 inches thick. The subsoil, about 16 inches thick, is gray and dark-gray silty clay loam mottled with olive brown and yellowish red. Below the subsoil is light-gray or gray silty clay loam.

The Lawson soils are somewhat poorly drained. These soils are commonly near stream channels and against upland slopes where small drainageways enter the bottom lands. The surface layer is black and very dark gray silt loam about 37 inches thick. Below this is dark grayish-brown loam and loamy sand mottled with dark yellowish brown and brown.

Minor soils in this association are the Tice, Huntsville, and Ross soils on the bottom lands and the Plano and Elburn soils on low terraces. Tice soils are somewhat poorly drained, and Huntsville and Ross soils are well drained and moderately well drained. Plano soils are well drained and moderately well drained, and Elburn soils are somewhat poorly drained.

This association is used primarily for cash-grain farming. Corn and soybeans are the main crops; other crops grown are small grains, grasses and legumes. The soils in this association are highly productive if properly managed. Overflow is a hazard. Only a small acreage of the soils is adequately protected from overflow. A few areas are in pasture and woodland. Permanent pasture is mainly bluegrass. Existing woodland is of low quality.

6. Clinton-Keomah association

Nearly level to moderately steep, somewhat poorly drained to well-drained soils that formed in more than 5 feet of loess; on uplands

This association is in several areas, mainly along Salt, Kickapoo, and Sugar Creeks. The largest area is near the town of Lake Fork. Nearly level soils occupy areas in the outer reaches of the drainage patterns. Gently sloping to moderately steep soils occupy ridges between drainageways and side slopes adjacent to creek valleys. In places, Clinton soils are on remnants of morainal ridges.

This association makes up about 4 percent of the county. About 47 percent of the association is Clinton soils, 30 percent is Keomah soils, and the remaining 23 percent is minor soils.

The Clinton soils have slopes of 0 to 18 percent and are well drained and moderately well drained. They are on ridges between drainageways and on side slopes. The surface layer is dark-brown silt loam about 7 inches thick, and the subsurface layer is yellowish-brown silt loam about 3 inches thick. The subsoil, about 37 inches thick, is dark yellowish-brown silty clay loam mottled with strong brown and light brownish gray. Below the subsoil is yellowish-brown silt loam.

The Keomah soils have slopes of 0 to 3 percent and are somewhat poorly drained. The surface layer is dark grayish-brown silt loam about 8 inches thick, and the subsurface layer is grayish-brown silt loam about 4 inches thick. The subsoil, about 32 inches thick, is silty clay loam. It is dark brown and is mottled with dark grayish brown and yellowish brown in the upper part. The lower part is mixed yellowish brown and pale brown. Below the subsoil is mixed brownish-gray and yellowish-brown silt loam.

Minor soils in this association are Clarksdale and Rushville soils. The Clarksdale soils are similar to the Keomah soils but have a thicker and darker colored surface layer. The Rushville soils are poorly drained and in depressions.

This association is used primarily for cash-grain farming. There are a few hog and cattle feeding operations. Corn and soybeans are the main crops; other crops grown are small grains, grasses, and legumes. Some areas are in pasture and woodland. Permanent pasture is mainly bluegrass, and existing woodland is of low quality. The soils in this association are moderately productive or highly productive if properly managed. Erosion is the main hazard. Wetness is a limitation in some places. Erosion control measures and practices that improve tilth and increase fertility are needed.

7. Clinton-Birkbeck-Miami association

Gently sloping to very steep, well drained and moderately well drained soils that formed either in 2 to 5 feet or more of loess and glacial till, or entirely in glacial till; on uplands

This association is in the glacial morainal area in the northeastern part of the county. It occupies areas along Kickapoo and Sugar Creeks. Steep slopes and narrow ridgetops are common near the creeks, but slopes are more gentle and longer in the outer reaches of the drainage patterns (fig. 7).

This association makes up about 3 percent of the county. About 32 percent of this association is Clinton soils, 20 percent is Birkbeck soils, 19 percent is Miami soils, and the remaining 29 percent is minor soils.

The Clinton soils in this association have slopes of 2 to 7 percent and are well drained and moderately well drained. They formed in loess more than 60 inches thick. The surface layer is dark-brown or brown silt loam about 7 inches thick, and the subsurface layer is yellowish-brown silt loam about 3 inches thick. The subsoil, about 37 inches thick, is dark yellowish-brown silty clay loam mottled with strong brown and light brownish gray. Yellowish-brown silt loam is below the subsoil.

Figure 7.—**Typical landscape in association 7, east of Union. Clinton soils are mainly gently sloping, and soils of the Birkbeck-Miami and Miami-Russell complexes are steeper.**

The Birkbeck soils have slopes of 2 to 12 percent and are moderately well drained. They are in complex patterns with Miami soils where slopes are 7 to 12 percent. Birkbeck soils formed in loess 40 to 60 inches thick and the underlying loamy glacial till. The surface layer is dark grayish-brown silt loam about 6 inches thick. The subsoil, about 45 inches thick, is dark yellowish-brown silty clay loam in the upper part. The lower part is dark yellowish-brown loam mottled with light brownish gray. Below the subsoil is mixed yellowish-brown and olive-brown loam.

The Miami soils have slopes of 7 to 60 percent and are well drained. They are in complex patterns with Birkbeck soils where slopes are 7 to 12 percent, and with Russell soils where slopes are 12 to 18 percent. They are in irregular patterns with Hennepin soils having slopes of 18 to 60 percent. Miami soils formed in glacial till. The surface layer is dark-brown silt loam or clay loam about 8 inches thick, and the subsoil is dark yellowish-brown clay loam about 31 inches thick. Below the subsoil is light olive-brown loam. Most areas of the cultivated Miami soils are eroded. Many till pebbles and stones are noticeable on the surface.

Minor soils in this association include the Hennepin, Russell, Clarksdale, Keomah, St. Charles, and Fayette soils. Hennepin, Russell, St. Charles, and Fayette soils are sloping and are well drained and moderately well drained. Clarksdale and Keomah soils are nearly level, are somewhat poorly drained, and occupy small areas.

This soil association is used primarily for cash-grain farming. There are a few hog and cattle feeding operations and dairy enterprises. Corn and soybeans are the main crops; other crops grown are small grains, grasses and legumes. A few areas are in pasture and woodland. Permanent pasture is mainly bluegrass. Existing woodland is of low quality. The soils in this association are moderately productive or highly productive if properly managed. Erosion is the main hazard, and erosion control measures are needed to reduce soil losses. Practices that improve tilth and increase fertility are also needed.

8. *Middletown-Alvin-Lamont association*

Nearly level to steep, well drained and moderately well drained soils that formed either in 3½ to 5 feet of loess and the underlying sand, or entirely in sand; on uplands

This association is mainly in the western part of the county along Salt Creek, north and east of Middletown. Small areas are along Salt Creek in the eastern part of the county and along Lake Fork in the southern part. Broad, gently sloping areas are between the strongly sloping to steep side slopes of drainageways. Numerous long, narrow ridges having gentle slopes are made up of wind-deposited sand (fig. 8).

Figure 8.—**Typical landscape in association 8. Alvin-Lamont soils occupy the tops of ridges, and Middletown soils are on slopes between the ridges.**

This association covers about 1 percent of the county. About 40 percent of this association is Middletown soils, 26 percent is Alvin-Lamont soils, and the remaining 34 percent is minor soils.

The Middletown soils have slopes of 1 to 15 percent and are well drained and moderately well drained. These soils formed in loess about 40 to 50 inches thick and in the underlying sand. The surface layer is dark-brown silt loam about 8 inches thick. The upper 40 inches of the subsoil is dark yellowish-brown silty clay loam. The lower 5 inches of the subsoil is friable loamy sand. Below the subsoil is strong-brown, loose sand.

The Alvin and Lamont soils are closely intermingled and were mapped in complexes. They have slopes of 2 to 30 percent and are well drained and moderately well drained. They formed in sand more than 60 inches thick. The surface layer of these soils is dark-brown sandy loam 3 to 8 inches thick. Their subsurface layer is brown or dark-brown sandy loam 3 to 10 inches thick. The subsoil of the Alvin soils is dark-brown clay loam and sandy clay loam about 25 inches thick. The subsoil of the Lamont soils is strong-brown sandy loam about 18 inches thick. Below the subsoil of both soils is loose, strong-brown sand.

Minor soils in this association are the Thebes, Clinton, and Keomah soils. Thebes and Clinton are well drained and moderately well drained, sloping soils. Thebes soils have loose sand at a depth of less than 40 inches. Keomah soils are somewhat poorly drained and are nearly level.

This association is used primarily for cash-grain farming. There are a few hog and cattle feeding operations. Corn and soybeans are the main crops; other crops grown are small grains, grasses, and legumes. A few areas are in pasture and woodland. Permanent pasture is mainly bluegrass. Existing woodland is of low quality. The soils in this association are moderately or highly productive if properly managed. Erosion is the main hazard, and erosion control measures are needed to reduce soil losses. Practices that improve tilth and increase fertility are also needed.

Descriptions of the Soils

This section describes the soil series and mapping units of Logan County. The acreage and proportionate extent of each mapping unit are given in table 4. The procedure is first to describe the soil series, and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs.

In comparing a mapping unit with a soil series, many will prefer to read the short description in paragraph form. It precedes the technical description that identifies layers by A, B, and C horizons and depth ranges. The technical profile descriptions are mainly for soil scientists and others who want detailed information about soils.

Unless otherwise indicated, the colors given in the descriptions are those of a moist soil. Some of the terms used to describe the soils are defined in the Glossary at the back of this survey.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the management group in which the mapping unit has been placed. The "Guide to Mapping Units" at the back of this survey lists the page on which each management group is described and gives the recreational group for each soil.

TABLE 4.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Alvin-Lamont sandy loams, 2 to 6 percent slopes, eroded	293	0.1
Alvin-Lamont sandy loams, 7 to 12 percent slopes, eroded	485	.1
Alvin-Lamont sandy loams, 12 to 30 percent slopes	462	.1
Birkbeck silt loam, 2 to 4 percent slopes	232	.1
Birkbeck silt loam, 4 to 7 percent slopes, eroded	914	.2
Birkbeck-Miami silt loams, 7 to 12 percent slopes, eroded	894	.2
Birkbeck-Miami complex, 7 to 12 percent slopes severely eroded	1,111	.3
Brenton silt loam	1,424	.4
Broadwell silt loam, 0 to 2 percent slopes	4,003	1.0
Broadwell silt loam, 2 to 4 percent slopes	9,980	2.5
Broadwell silt loam, 4 to 7 percent slopes, eroded	2,752	.7
Broadwell silt loam, 7 to 12 percent slopes, eroded	365	.1
Brooklyn silt loam	1,042	.3
Catlin silt loam, 2 to 4 percent slopes	1,045	.3
Catlin silt loam, 4 to 7 percent slopes, eroded	3,734	.9
Catlin silt loam, 7 to 12 percent slopes, eroded	610	.2
Clarksdale silt loam	2,377	.6
Clinton silt loam, 0 to 2 percent slopes	1,000	.3
Clinton silt loam, 2 to 4 percent slopes	5,692	1.4
Clinton silt loam, 4 to 7 percent slopes, eroded	2,936	.7
Clinton silt loam, 7 to 12 percent slopes, eroded	1,180	.3
Clinton soils, 7 to 12 percent slopes, severely eroded	479	.1
Clinton silt loam, 12 to 18 percent slopes, eroded	262	.1
Denny silt loam	9,233	2.3
Dickinson-Onarga sandy loams, 0 to 2 percent slopes	614	.2
Dickinson-Onarga sandy loams, 2 to 7 percent slopes	1,820	.5
Dickinson-Onarga sandy loams, 2 to 7 percent slopes, eroded	538	.1
Dickinson-Onarga sandy loams, 7 to 15 percent slopes, eroded	563	.1
Drummer silty clay loam	4,949	1.3
Elburn silt loam	3,311	.8
Elkhart silt loam, 4 to 7 percent slopes, eroded	363	.1
Elkhart silt loam, 7 to 12 percent slopes, eroded	220	.1
Fayette silt loam	696	.2
Harpster silty clay loam	4,759	1.2
Hartsburg silty clay loam	8,906	2.2
Hennepin and Miami soils, 18 to 60 percent slopes	1,080	.3
Hickory and Sylvan soils, 15 to 50 percent slopes, eroded	825	.2
Huntsville silt loam	1,419	.4
Ipava silt loam	78,312	19.6
Keomah silt loam	5,126	1.3
Knight silt loam	629	.2
Lawndale silt loam	3,659	.9
Lawson silt loam	8,933	2.3
Miami-Russell silt loams, 12 to 18 percent slopes, eroded	634	.2
Middletown silt loam, 1 to 4 percent slopes	726	.2
Middletown silt loam, 4 to 7 percent slopes, eroded	706	.2
Middletown silt loam, 7 to 15 percent slopes, eroded	460	.1
Muscatine silt loam	5,617	1.4
Parr silt loam, 4 to 7 percent slopes, eroded	182	(1)
Parr silt loam, 7 to 18 percent slopes, eroded	915	.2
Pillot silt loam, 1 to 4 percent slopes	534	.1
Pillot silt loam, 4 to 10 percent slopes, eroded	906	.2
Plano silt loam, 0 to 2 percent slopes	3,283	.8
Plano silt loam, 2 to 4 percent slopes	2,823	.7
Plano silt loam, 4 to 7 percent slopes, eroded	1,386	.3
Proctor silt loam, 0 to 2 percent slopes	944	.2
Proctor silt loam, 2 to 4 percent slopes	661	.2
Proctor silt loam, 4 to 7 percent slopes, eroded	1,049	.3
Proctor silt loam, 7 to 12 percent slopes, eroded	518	.1
Radford silt loam	956	.2
Ross loam	607	.2
Rushville silt loam	749	.2
Sable silty clay loam	81,793	20.5
St. Charles silt loam, 1 to 4 percent slopes	712	.2
St. Charles silt loam, 4 to 7 percent slopes, eroded	475	.1
Sawmill silty clay loam	18,087	4.5
Sawmill silt loam, overwash	4,728	1.2
Shiloh silty clay loam	4,998	1.3
Tallula-Bold silt loams, 6 to 15 percent slopes, eroded	702	.2
Tama silt loam, 0 to 2 percent slopes	24,095	6.1
Tama silt loam, 2 to 4 percent slopes	42,589	10.6
Tama silt loam, 4 to 7 percent slopes, eroded	9,467	2.4
Tama silt loam, 7 to 12 percent slopes, eroded	1,275	.3
Thebes silt loam, 3 to 7 percent slopes, eroded	435	.1
Thebes soils, 7 to 12 percent slopes, severely eroded	924	.2
Thebes silt loam, 12 to 35 percent slopes, eroded	471	.1
Tice silty clay loam	1,854	.5
Water (streams and ponds)	1,674	.4
Borrow areas	339	.1
Gravel pits	275	.1
Mine dumps	18	(1)
Made land	99	(1)
Limestone quarry	187	(1)
Total	398,080	100.0

1 Less than 0.05 percent.

Alvin Series

The Alvin series consists of well drained and moderately well drained, gently sloping to steep soils. These soils are mainly on the uplands in Corwin Township. A few areas are on stream terraces. Alvin soils formed in wind-deposited sandy material more than 60 inches thick.

In a representative profile, the surface layer is very dark grayish-brown sandy loam about 3 inches thick. The subsurface layer is dark-brown sandy loam about 6 inches thick. The subsoil is about 25 inches thick. The uppermost 5 inches is dark yellowish-brown heavy loam; the next 10 inches is dark-brown clay loam; the next 7 inches is dark-brown sandy clay loam; and the lowermost 3 inches is dark-brown sandy loam. The underlying material is strong-brown, loose sand.

Alvin soils are low in organic-matter content and natural fertility. The subsoil is moderately permeable, and the underlying material is rapidly permeable. The soils have moderate available water capacity.

A considerable acreage of the Alvin soils is cultivated, but a small acreage is in pasture and woodland.

In Logan County, Alvin soils are so closely intermingled with Lamont soils that they were mapped only in complexes with those soils.

Representative profile of Alvin sandy loam, from an area of Alvin-Lamont sandy loams, 12 to 30 percent slopes, in pastured woods about 3.5 miles east of Middletown, 219 feet west and 66 feet south of the NE. corner of NW¼ sec. 15, T. 19 N., R. 4 W.:

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) sandy loam; weak to moderate, very fine, granular structure; friable; slightly acid; clear, smooth boundary.

A2—3 to 9 inches, dark-brown (10YR 4/3) sandy loam; many black (10YR 2/1) worm channels and worm casts; silt grains light gray (10YR 7/2) when dry; weak, medium, platy structure where undisturbed, breaking to weak, medium, granular structure where disturbed; friable; medium acid; clear, smooth boundary.

B1—9 to 14 inches, dark yellowish-brown (10YR 4/4) heavy loam; few very dark grayish-brown (10YR 3/2) flecks; weak, fine, subangular blocky structure; friable; very strongly acid; gradual, smooth boundary.

B21t—14 to 24 inches, dark-brown (7.5YR 4/4) clay loam; thin, continuous, dark-brown (7.5YR 4/4) clay films; weak to moderate, fine and medium, subangular blocky structure; firm; very strongly acid; clear, smooth boundary.

B22t—24 to 31 inches, dark-brown (7.5YR 4/4) sandy clay loam; thin, continuous, dark-brown (7.5YR 4/4) clay films; weak to moderate, coarse, subangular blocky structure; firm; strongly acid; clear, smooth boundary.

B3—31 to 34 inches, dark-brown (7.5YR 4/4) sandy loam; very weak, coarse, subangular blocky structure; friable; strongly acid; clear, smooth boundary.

C—34 to 60 inches, strong-brown (7.5YR 5/8) sand; single grain; loose; medium acid.

Color of the A1 horizon ranges from very dark grayish brown (10YR 3/2) to dark brown or brown (10YR 4/3). Texture ranges from sandy loam to sandy clay loam. Thickness is 3 to 8 inches. The A2 horizon has been mixed with the A1 horizon in most cultivated areas. Where present, the A2 horizon ranges from 5 to 10 inches in thickness; it is dark brown or brown (10YR 4/3) to dark grayish brown (10YR 4/2). Texture of the B2 horizon is clay loam or sandy clay loam.

Alvin soils are next to Lamont soils. Thebes and Middletown soils are nearby. Alvin soils contain more clay in the subsoil than Lamont soils. They contain more sand in the surface layer and upper part of the subsoil than Thebes and Middletown soils.

Alvin-Lamont sandy loams, 2 to 6 percent slopes, eroded (975C2).—These soils are on long, narrow ridges or isolated knobs. The present surface layer of these soils, about 5 to 8 inches thick, is a mixture of the original surface and subsurface layers and part of the upper subsoil. The profiles of these soils are otherwise similar to those described as representative for the series. The Alvin soils make up 50 to 75 percent of this mapping unit.

Included in mapping are small areas of Middletown and Thebes soils.

The soils of this complex are well suited to crops commonly grown in the county. Erosion is a hazard, and droughtiness is a limitation. Erosion control measures are needed to reduce soil and water losses. Management practices that increase organic-matter content and fertility are also needed. Management group IIIe–3.

Alvin-Lamont sandy loams, 7 to 12 percent slopes, eroded (975D2).—These soils are on long, narrow ridges and short side slopes of drainageways. The subsurface layer of these soils is mixed with the surface layer, and their combined thickness corresponds to plow depth. Total thickness of the surface and subsurface layers and the subsoil is less than that of the soil having the representative profile. The Alvin soil makes up about 50 to 75 percent of this mapping unit.

Included in mapping are small areas where the present surface layer consists entirely of subsoil material and small areas of Middletown and Thebes soils.

The soils of this complex are suited to small grains, hay, and improved pasture. Erosion is a hazard, and low fertility and droughtiness are limitations. Erosion control measures will reduce soil and water losses. Management practices that add organic matter will improve tilth and increase fertility and available water capacity. Under proper management a row crop can be grown occasionally. Management group IIIe–3.

Alvin-Lamont sandy loams, 12 to 30 percent slopes (975E).—These soils have the profiles described as representative for their respective series. Most areas of this mapping unit are in Corwin township along Salt Creek. The soils are generally on short side slopes of drainageways, but a few areas are on long, narrow ridges. The Alvin soil makes up about 50 percent of this mapping unit.

Included in mapping are small eroded areas and small areas of soils that are loamy sand or sand throughout the profile.

Some areas of this mapping unit are cultivated, and some are in pasture or woodland. The soils are not suited to intensive cropping. Erosion is a hazard. If they are cultivated, the soils are suited to close-growing crops, such as small grains, grasses, and legumes. Proper management is required if these soils are used for pasture or woodland. Existing woodland is of low quality. Management group VIe–1.

Birkbeck Series

The Birkbeck series consists of moderately well drained, gently sloping and strongly sloping soils on uplands. These soils are in the northeast part of the county in Eminence and Atlanta Townships. They formed in loess 40 to 60 inches thick and the underlying loam glacial till. The native vegetation was hardwood trees.

In a representative profile, the surface layer is dark grayish-brown silt loam about 6 inches thick. The subsoil is about 45 inches thick. The upper 31 inches of the subsoil is dark yellowish-brown silty clay loam, and the next 10 inches is dark-yellowish brown heavy silt loam mottled with light brownish gray. The lowermost 4 inches is dark yellowish-brown loam mottled with light brownish gray. The underlying material is yellowish-brown and olive-brown loam till.

Birkbeck soils are low in organic-matter content and moderate in natural fertility. They have moderate permeability and high available water capacity.

Most areas of the Birkbeck soils are cultivated, but some are in pasture or woodland.

Representative profile of Birkbeck silt loam, 4 to 7 percent slopes, eroded, in a cultivated field north of the SW. of Atlanta, 783 feet east and 177 feet north of the SW. corner of SE¼NE¼ sec. 23, T. 21 N., R. 1 W.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, very fine and fine, granular structure; friable; neutral; abrupt, smooth boundary.

B1—6 to 9 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; moderate, very fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21t—9 to 20 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, continuous, dark yellowish-brown (10YR 3/4) clay films; moderate, fine, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B22t—20 to 29 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, continuous, dark yellowish-brown (10YR 3/4) clay films; moderate, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B23t—29 to 37 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; thin, discontinuous, dark yellowish-brown (10 YR 3/4) clay films, mainly on vertical faces of peds; moderate, coarse, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B31—37 to 47 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; few patches of dark yellowish-brown (10YR 3/4) clay films; few, fine, distinct, light brownish-gray (10YR 6/2) mottles and yellowish-red (5YR 4/6) mottles; weak, coarse, subangular blocky structure; friable; medium acid; clear, smooth boundary.

IIB32—47 to 51 inches, dark yellowish-brown (10YR 4/4) loam; common, fine, distinct, light brownish-gray (10YR 6/2) mottles; weak, coarse, subangular blocky structure; friable; medium acid; abrupt, smooth boundary.

IIC—51 to 60 inches, mixed yellowish-brown (10YR 5/4) and olive-brown (2.5Y 4/4) loam; massive; friable; neutral; many small till pebbles and stones.

Color of the AP horizon ranges from dark grayish brown (10YR 4/2) to dark brown (10YR 4/3), and texture is generally silt loam but ranges to silty clay loam in eroded soils. Depth to loam glacial till is 40 to 60 inches. The till is calcareous but, in many places, not within a depth of 60 inches.

Birkbeck soils are in a landscape with Clinton, Russell, and Miami soils. The lower part of the subsoil of Birkbeck soils formed in till, whereas Clinton soils formed entirely in loess. The upper 40 inches of the subsoil in Birkbeck soils formed in loess, whereas the upper 40 inches of the subsoil in Russell soils formed in loess and till, and the subsoil of Miami soils formed almost entirely in till.

Birkbeck silt loam, 2 to 4 percent slopes (233B).—This soil has a profile similar to the one described as representative for the Birkbeck series, but it has a thicker surface layer, and in some places the subsoil is mottle free. The soil occupies irregular divides between the more sloping Birkbeck soils or associated soils.

Included in mapping are soils having slopes of less than 2 percent and soils having slopes of more than 4 percent.

This soil is suited to the crops commonly grown in the county. Erosion is a hazard, and crusts form on the surface. Fertility and tilth need to be improved. Areas are small and irregular and are generally farmed in the same way as surrounding soils. Erosion control measures, such as contouring, are needed. Management group IIe–1.

Birkbeck silt loam, 4 to 7 percent slopes, eroded (233C2).—This is the most extensive of the Birkbeck soils, and it has the profile described as representative for the series. It occupies short side slopes of drainageways or the upper part of long slopes. The present surface layer is a mixture of the original surface layer and some of the upper part of the subsoil. Thickness of the present surface layer depends on the depth of plowing. In some places the lower part of the subsoil is mottle free.

Included in mapping are small areas of slightly eroded and severely eroded soils. The included slightly eroded soils are similar to Birkbeck silt loam, 2 to 4 percent slopes. The severely eroded soils are dark yellowish brown and contain more clay in the surface layer.

This soil is suited to the crops commonly grown in the county. Erosion is a hazard. Low fertility and poor tilth are limitations. The surface layer is low in organic-matter content and crusts easily. This soil is suited to intensive cropping if erosion control measures are used. Management group IIe–1.

Birkbeck-Miami silt loams, 7 to 12 percent slopes, eroded (968D2).—These soils occupy side slopes of drainageways. Birkbeck silt loam makes up 60 to 75 percent of the acreage.

Included in mapping are small areas of soils that are severely eroded and small areas of Russell soils.

The soils of this complex are suited to the crops commonly grown in the county. They are not suited to intensive cropping. Erosion is a severe hazard. Minimum tillage and other erosion control practices will help to reduce soil loss. Management practices that supply organic matter will help to improve tilth and increase fertility. Management group IIIe–1.

Birkbeck-Miami complex, 7 to 12 percent slopes, severely eroded (968D3).—The soils of this complex are on short side slopes of drainageways. The surface layer is mostly subsoil material and ranges from silt loam to clay loam in texture. The subsoil of these soils is somewhat thinner than that described as representative for their series. About 50 percent of the acreage is Birkbeck soils, and nearly 50 percent is Miami soils.

Included in mapping are small areas of Russell soils.

The soils of this complex are suited to all crops commonly grown in the county, but they are not suited to intensive cultivation. They are best suited to small grains and hay. Erosion is a severe hazard, fertility is low, and tilth is poor. Minimum tillage and conservation of residue will help to reduce soil losses, improve tilth, and maintain fertility. Management group IVe–1.

Bold Series

The Bold series consists of well-drained, strongly sloping and moderately steep soils on uplands. These soils are mostly in Corwin Township, but they are also in several places along Sugar Creek. They formed in loess. Erosion has removed most of the evidence that would indicate the kind of native vegetation under which these soils formed. Because they are intermingled with other dark-colored soils, it is assumed that they formed under mixed prairie grasses.

In a representative profile, the surface layer is calcareous, dark-brown silt loam about 8 inches thick. The material underlying the surface layer is calcareous, yellowish-brown silt loam.

Bold soils are low in organic-matter content and natural fertility. They have moderate permeability and high available water capacity. They contain excess lime.

Most areas of the Bold soils are cultivated, but a few are in pasture.

In Logan County, Bold soils are so closely intermingled with Tallula soils that they were mapped in a complex with those soils. For a description of that complex, see the Tallula series.

Representative profile of a Bold silt loam having slopes of 6 to 15 percent, from an area of Tallula-Bold silt loams, 6 to 15 percent slopes, eroded, in a cultivated field about 2 miles south of Hartsburg, 528 feet west and 50 feet north of the SE. corner of sec. 32, T. 21 N., R. 3 W.:

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; yellowish-brown (10YR 5/4) splotches; few yellowish-red (5 YR 4/8) and dark-red (2.5YR 3/6) iron and manganese concretions; weak, fine and medium, granular structure; friable; calcareous; abrupt, smooth boundary.

C1—8 to 14 inches, yellowish-brown (10YR 5/4) silt loam; many, medium, distinct, pale-brown (10YR 6/3) mottles and common, medium, prominent, strong-brown (7.5YR 5/8) mottles; few yellowish-red (5YR 4/8) and dark-red (2.5YR 3/6) iron and manganese concretions; massive; friable; calcareous; gradual, smooth boundary.

C2—14 to 34 inches, yellowish-brown (10YR 5/4) silt loam; many, medium, prominent, strong-brown (7.5YR 5/8) mottles; few yellowish-red (5YR 4/8) and dark-red (2.5YR 3/6) iron and manganese concretions; massive; friable; calcareous; gradual, wavy boundary.

C3—34 to 36 inches, yellowish-red (5YR 5/8) and dark reddish-brown (5YR 3/4) silt loam bands 1/16 to 1/8 inch thick; some bands of yellowish brown (10YR 5/4); massive; friable; calcareous; abrupt, wavy boundary.

C4—36 to 39 inches, yellowish-brown (10YR 5/8) and light brownish-gray (10YR 6/2) silt loam bands; massive, but breaks along bands; friable, calcareous; abrupt, wavy boundary.

C5—39 to 60 inches, mixed yellowish-brown (10YR 5/8) and light brownish-gray (10YR 6/2) silt loam; massive; friable; calcareous.

Color of the Ap horizon ranges from dark brown (10YR 4/3) to yellowish brown (10YR 5/4). Thickness of this horizon depends on the depth of plowing.

Bold soils are next to Tallula soils. Elkhart and Tama soils are nearby. All these soils formed in loess, but Bold soils are shallower to calcareous loess and have a lighter colored, thinner surface layer than Tallula soils. They have less clay below the surface layer than the Tama and Elkhart soils.

Brenton Series

The Brenton series consists of somewhat poorly drained, nearly level soils on terraces. These soils occupy low stream terraces, mainly in the western part of the county along Salt Creek. They formed in 20 to 40 inches of loess or silty water-laid material and in the underlying stratified loamy outwash. The native vegetation was mixed prairie grasses.

In a representative profile, the surface layer is black silt loam about 14 inches thick. The subsoil is about 28 inches thick. The upper 16 inches is mainly dark-brown silty clay loam mottled with yellowish brown. The lower 12 inches is yellowish-brown clay loam. The underlying material, to a depth of 58 inches, is brown loam mottled with yellowish brown.

Brenton soils are high in organic-matter content and natural fertility. They have moderate permeability and very high available water capacity.

Most areas of Brenton soils are cultivated. The soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Brenton silt loam, in a cultivated field about 1.5 miles southwest of New Holland, 249 feet north and 72 feet east of the SW. corner of sec. 19, T. 20 N., R. 4 W.:

Ap—0 to 8 inches, black (10YR 2/1) silt loam; moderate, very fine and fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A1—8 to 14 inches, black (10YR 2/1) silt loam; moderate, fine and medium, granular structure; friable; medium acid; clear, smooth boundary.

B1—14 to 17 inches, very dark brown (10YR 2/2) light silty clay loam with flecks of dark brown (10YR 4/3); very dark grayish brown (10YR 3/2) when crushed; moderate, very fine and fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21t—17 to 24 inches, dark-brown (10YR 4/3) silty clay loam, dark grayish brown (10YR 4/2) when crushed; thin, discontinuous, dark grayish-brown (10YR 4/2) clay films, and thin, patchy, very dark gray (10YR 3/1) coatings, mainly in the upper part; few, fine, faint, yellowish-brown (10YR 5/6) mottles; moderate, fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B22t—24 to 30 inches, dark-brown (10YR 4/3) silty clay loam, dark brown (10YR 4/3) when crushed; thin, discontinuous, dark grayish-brown (10YR 4/2) clay films; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; many iron and manganese concretions; moderate, medium, subangular blocky structure; friable; slightly acid; gradual, smooth boundary.

IIB3—30 to 42 inches, yellowish-brown (10YR 5/4) clay loam or light clay loam, yellowish brown (10YR 5/6) when crushed; thin, patchy, dark-brown (10YR 4/3) clay films; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure; friable; slightly acid; gradual, smooth boundary.

IIC1—42 to 58 inches, brown (10YR 5/3) loam, yellowish brown (10YR 5/6) when crushed; common, fine, distinct, yellowish-brown (10YR 5/6) mottles and iron and manganese concretions; massive; friable; neutral; abrupt, smooth boundary.

IIC2—58 to 60 inches, yellowish-brown (10YR 5/4) light sandy loam; single grain; loose; neutral.

Color of the Ap horizon is black (10YR 2/1) to very dark gray (10YR 3/1). Texture is centered on silt loam but ranges to light silty clay loam in some places. Combined thickness of the Ap and A1 horizons is from 10 to 18 inches. Thickness of the solum ranges from 38 to 45 inches. Texture of the B3 horizon ranges from clay loam to sandy loam.

Brenton soils are associated with Proctor and Drummer soils. They are darker colored and more poorly drained than Proctor soils. Brenton soils have less clay in the surface layer and have better natural drainage than Drummer soils.

Brenton silt loam (149).—This is the only Brenton soil mapped in the county. It typically occupies irregularly shaped areas on low terraces near streams. These nearly level areas are slightly higher than the surrounding more poorly drained soils. Slope ranges from 0 to 3 percent.

Included in mapping are small areas of Proctor and Drummer soils. Also included are soils having a loam surface layer and soils in which no part of the lower subsoil formed in coarser material. Small sandy areas less than one acre in size are shown on the soil map by a conventional symbol.

This soil is well suited to crops commonly grown in the county. Brenton silt loam has few limitations for intensive cropping. Runoff is slow, but tile drains and shallow surface ditches will improve drainage where needed. In some places the soil is subject to flooding or is isolated by the flooded lower soils surrounding it. Management group I–4.

Broadwell Series

The Broadwell series consists of well drained and moderately well drained, nearly level to strongly sloping soils on uplands. These soils are common in the northwestern part of the county, but they are also in several other places in the county. They formed in 40 to 50 inches of loess and in the underlying sand. The native vegetation was mixed prairie grasses.

In a representative profile, the surface layer is very dark brown silt loam about 15 inches thick. The subsoil is about 39 inches thick. The upper 33 inches of the subsoil is dark yellowish-brown silty clay loam. The lower 6 inches is dark yellowish-brown loamy sand. The underlying material is yellowish-brown, loose sand.

Broadwell soils are high in organic-matter content and natural fertility. They have moderate permeability and high available water capacity.

Almost all areas of the Broadwell soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Broadwell silt loam, 2 to 4 percent slopes, in a cultivated field about 0.5 mile from Emden, 441 feet north and 294 feet east of the SW. corner of sec. 5, T. 21 N., R. 3 W.:

Ap—0 to 6 inches, very dark brown (10YR 2/2) silt loam; very dark grayish brown (10YR 3/2) when crushed, and dark grayish brown (10YR 4/2) when dry; moderate, fine, granular structure; friable; neutral; abrupt, smooth boundary.

A1—6 to 15 inches, very dark brown (10YR 2/2) silt loam; very dark grayish brown (10YR 3/2) when crushed; flecks of dark yellowish brown (10YR 4/4); moderate, fine and medium, granular structure; friable; neutral; clear, smooth boundary.

B1—15 to 24 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; dark brown (10YR 3/3) when crushed, brown (10YR 5/3) when dry; has a scattering of very dark brown (10YR 2/2) coatings; moderate, very fine, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B21t—24 to 32 inches, dark yellowish-brown (10YR 4/4) silty clay loam; dark brown or brown (10YR 4/3) when crushed; thin, patchy, dark yellowish-brown (10YR 3/4) clay films; few black (5YR 2/1) iron and manganese concretions; moderate, fine, subangular blocky structure; firm; medium acid; gradual, smooth boundary.

B22t—32 to 42 inches, dark yellowish-brown (10YR 4/4) silty clay loam; dark yellowish brown (10YR 4/4) when crushed; thin, patchy, dark yellowish-brown (10YR 3/4) clay films; moderate, fine, subangular blocky structure; firm; medium acid; gradual, smooth boundary.

B31—42 to 48 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; dark yellowish brown (10YR 4/4) when crushed; weak to moderate, coarse, subangular blocky structure; friable; medium acid; abrupt, smooth boundary.

IIB32—48 to 54 inches, dark yellowish-brown (10YR 4/4) loamy fine sand; few areas of dark yellowish-brown (10YR 3/4) coatings; weak, coarse, subangular blocky structure; friable; slightly acid; gradual, smooth boundary.

IIC—54 to 60 inches, yellowish-brown (10YR 5/6) fine sand; single grain; loose; slightly acid.

Color of the Ap horizon ranges from very dark brown (10YR 2/2) to dark brown (10YR 3/3). Combined thickness of the Ap and A1 horizons ranges from 10 to 17 inches. Thickness of the IIB32 horizon is 5 to 15 inches. Depth to sand ranges from 42 to 58 inches.

In mapping units 684C2 and 684D2, the combined thickness of the Ap and A1 horizons is less than that defined for the series, but this difference does not alter the usefulness or behavior of these soils.

Broadwell soils are in patterns with Lawndale, Pillot, Dickinson, and Onarga soils. The Broadwell soils have better drainage than Lawndale soils. They lack the coarser textures of the Dickinson and Onarga soils. Broadwell soils differ from Pillot soils because they contain no loose sand above a depth of 40 inches.

Broadwell silt loam, 0 to 2 percent slopes (684A).—This soil occupies small areas among areas of sloping soils. Its profile is similar to that described as representative for the series, but in some places the subsoil is mottled.

Included in mapping are small areas of Lawndale and Pillot soils. Sandy areas less than one acre in size are shown on the soil map by a conventional symbol.

This soil is well suited to crops commonly grown in the county. It has few limitations and is well suited to intensive cultivation. Erosion is not a hazard, and drainage is seldom needed. Management group I–2.

Broadwell silt loam, 2 to 4 percent slopes (684B).—This is the most extensive Broadwell soil in the county. It has the profile described as representative for the series. This soil occupies long, narrow ridges and is on short side slopes of drainageways. In some places it occupies broad, gentle slopes of morainal ridges.

Included in mapping are small areas of Pillot soils and small eroded areas. Sandy areas less than one acre in size are shown on the soil map by a conventional symbol.

This soil is suited to the crops commonly grown in the county, but erosion is a hazard. Management practices that include erosion control measures are needed to reduce soil losses if cultivation is intensive. Management group IIe–2.

Broadwell silt loam, 4 to 7 percent slopes, eroded (684C2).—This soil is on short side slopes along drainageways, and in some places it occupies longer slopes on some of the morainal ridges in the northwestern part of the county. The surface layer and subsoil are thinner than those described in the representative profile for the series. Thickness of the surface layer depends on the depth of plowing. Plowing mixes subsoil material with the original surface layer. The present surface layer is less friable and is lower in organic-matter content and fertility than the original one.

Included in mapping are small areas of Pillot soils and areas that are not eroded. The areas that are not eroded have a thicker, darker colored surface layer than this soil. Sandy areas that are smaller than one acre in size are shown on the soil map by a conventional symbol.

This soil is suited to the crops commonly grown in the county, but erosion is a hazard. It is not suited to intensive cultivation unless protected from further erosion. Terracing, contouring, minimum tillage, conservation of residues, and grassed waterways will help to control erosion and maintain fertility. Management group IIe–2.

Broadwell silt loam, 7 to 12 percent slopes, eroded (684D2).—This soil occupies short side slopes along drainageways. The profile of this soil has a thinner surface layer than that described as representative for the series. Thickness of the surface layer is about equal to depth of plowing. This soil is less friable, lower in organic-matter content and fertility, and more difficult to keep in good tilth than uneroded Broadwell soils.

Included in mapping are small areas in which the surface layer is almost entirely dark yellowish-brown subsoil material. These areas are more clayey and less friable than uneroded Broadwell soils. Also included are small areas of Pillot soils and small areas that have a thicker, darker colored surface layer.

This soil is suited to crops commonly grown in the county, but erosion is a hazard and poor tilth is a limitation. The soil is not suited to intensive cultivation. Erosion control practices are needed to reduce further soil and water losses. Grasses and legumes are needed in the cropping sequence. Row crops must be grown less frequently. Additions of organic matter increase fertility and improve tilth. Management group IIIe–2.

Brooklyn Series

The Brooklyn series consists of poorly drained, nearly level soils in depressions. These soils are common in the northwestern part of the county, but they are also in a few other places. They formed under mixed prairie grasses in loess 40 to 60 inches thick and in the underlying sand.

In a representative profile, the surface layer is very dark grayish-brown silt loam about 7 inches thick. The subsurface layer is gray silt loam about 9 inches thick. The subsoil, about 35 inches thick, is dark-gray silty clay loam mottled with strong brown in the upper 24 inches. The lower 11 inches is gray silty clay loam to sandy clay loam mottled with strong brown. The underlying material, to a depth of 60 inches, is gray loamy sand.

Brooklyn soils have a moderate organic-matter content and natural fertility. They have slow permeability and high available water capacity.

Nearly all areas of Brooklyn soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Brooklyn silt loam, in a cultivated field about 2.5 miles south of Emden, 198 feet east along road from 0.5 mile line, and 287 feet south in SW¼ SE¼ sec. 13, T. 21 N., R. 4 W.:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; weak to moderate, very fine, granular structure; friable; medium acid; abrupt, smooth boundary.

A21—7 to 12 inches, gray (10YR 5/1) silt loam; many dark reddish-brown (5YR 2/2) iron and manganese concretions and stains; weak, thin and medium, platy structure; friable; strongly acid; clear, smooth boundary.

A22—12 to 16 inches, gray (10YR 5/1) silt loam; common, fine, distinct, dark reddish-brown (5YR 3/4) mottles; weak, fine, granular structure; friable; strongly acid; abrupt, smooth boundary.

B1tg—16 to 19 inches, dark-gray (10YR 4/1) silty clay loam; thick, continuous, dark-gray (10YR 4/1) clay films; many, medium, prominent, strong-brown (7.5YR 5/6) mottles; weak to moderate, very fine, subangular blocky structure; firm; strongly acid; clear, smooth boundary.

B21tg—19 to 29 inches, dark-gray (5Y 4/1) heavy silty clay loam; thick, continuous, gray (N 5/0) clay films; many, medium, prominent, strong-brown (7.5YR 5/8) mottles; some yellowish-red (5YR 4/6) iron and manganese stains; moderate, medium, subangular blocky structure; firm; strongly acid; gradual, smooth boundary.

B22tg—29 to 40 inches, dark-gray (5Y 4/1) silty clay loam; thick, continuous, gray (5Y 5/1) clay films; medium, prominent, strong-brown (7.5YR 5/8) mottles; some dark reddish-brown (5YR 2/2) iron and manganese concretions; moderate, coarse, prismatic structure where undisturbed, breaking to moderate, medium, subangular and angular blocky structure; firm; strongly acid; clear, smooth boundary.

B31g—40 to 47 inches, mixed gray (N 4/0) and strong-brown (7.5YR 5/8) silty clay loam; thin, continuous, gray (5Y 5/1) clay films; moderate, coarse, subangular and angular blocky structure; firm; strongly acid; clear, wavy boundary.

IIB32g—47 to 51 inches, gray (2.5Y 5/1) sandy clay loam; many, coarse, prominent, strong-brown (7.5YR 5/8) mottles; weak, coarse, subangular blocky structure; strongly acid; clear, irregular boundary.

IIC—51 to 60 inches, gray (10YR 5/1) loamy sand; a few reddish-brown (5YR 4/4) and yellowish-red (5YR 4/6) iron and manganese stains; weak, coarse, subangular blocky structure; strongly acid.

Color of the Ap horizon is very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). Color of the A2 horizon ranges from gray (10YR 5/1) to dark grayish brown (10YR 4/2), and thickness is 8 to 16 inches. Texture of the B2 horizon is centered on heavy silty clay loam, but ranges from light silty clay loam to light silty clay. Texture of the IIB32g horizon is sandy clay loam to sandy loam. Depth to sand ranges from 40 to 58 inches.

Brooklyn soils formed in material similar to that in which the nearby Lawndale and Broadwell soils formed, but they have poorer natural drainage and contain more clay in the subsoil. Brooklyn soils also have a distinctive gray subsurface layer that Lawndale and Broadwell soils lack.

Brooklyn silt loam (136).—This is the only Brooklyn soil mapped in the county. It occupies depressions of different shapes that range from less than one acre to more than 16 acres in size. Slope is less than 2 percent. The soil is easily identified because it has a distinctive gray cast that contrasts with the surrounding dark-colored soils.

Included in mapping are small areas that have silty overwash and areas of similar soils that have a thicker subsurface layer.

If adequately drained and otherwise well managed, this soil is suited to crops commonly grown in the county. Wetness is the main limitation. Runoff is slow or ponded. In many places this soil lacks an outlet for drainage and some type of artificial drainage is needed. Tile drains do not function properly because of slow permeability. Tile inlets or shallow surface ditches can be used to drain this soil. Crusting of the surface is a limitation. Additions of organic matter are needed to improve tilth. Management group IIw–3.

Catlin Series

The Catlin series consists of well drained and moderately well drained, gently sloping to strongly sloping soils on uplands. These soils are in the northeastern part of the county. They formed under mixed prairie grasses in loess 40 to 60 inches thick and the underlying loam glacial till.

In a representative profile, the surface layer is very dark grayish-brown silt loam about 10 inches thick. The subsoil is about 42 inches thick. Its uppermost 31 inches is dark yellowish-brown silty clay loam; the next 5 inches is yellowish-brown heavy silt loam; and the lower 6 inches is yellowish-brown clay loam. The underlying material, to a depth of 60 inches, is yellowish-brown and light olive-brown loam.

Catlin soils are low to moderate in organic-matter content and high in natural fertility. They have moderate permeability and high available water capacity.

Most areas of Catlin soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Catlin silt loam, 2 to 4 percent slopes, in a cultivated field about 3 miles west of Atlanta, 927 feet north and 310 feet west of the SE. corner of sec. 22, T. 21 N., R. 2 W.:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable; neutral; abrupt, smooth boundary.

B1—10 to 13 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; some very dark grayish-brown (10YR 3/2) organic coatings; moderate, very fine, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B21t—13 to 22 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, discontinuous, dark yellowish-brown (10YR 3/4) clay films; moderate, very fine and fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B22t—22 to 31 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, discontinuous, dark yellowish-brown (10YR 3/4) clay films; moderate, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B31—31 to 41 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; patchy, dark yellowish-brown (10YR 3/4) clay films; moderate, coarse, subangular blocky structure; firm; slightly acid; clear, smooth boundary.

B32—41 to 46 inches, yellowish-brown (10YR 5/4) heavy silt loam; a few, patchy, dark yellowish-brown (10YR 3/4) clay films; weak, coarse, subangular blocky structure; friable; neutral; clear, smooth boundary.

IIB33—46 to 52 inches, yellowish-brown (10YR 5/4) clay loam; some dark yellowish-brown (10YR 3/4) clay films, mainly on vertical faces of peds; weak, coarse, subangular blocky structure; friable; neutral; abrupt, wavy boundary.

IIC—52 to 60 inches, mixed yellowish-brown (10YR 5/4) and light olive-brown (2.5Y 5/4) loam; massive; calcareous; small till pebbles and stones are present.

Color of the Ap horizon ranges from very dark brown (10YR 2/2) to dark brown (10YR 4/3). Thickness of this horizon ranges from 10 to 12 inches. Texture of the B2 horizon is centered on silty clay loam, but texture of the lower B3 horizon ranges from silt loam with a high sand content to clay loam. Depth to loam glacial till ranges from 40 to 60 inches. The till is calcareous but, in many places, not within a depth of 60 inches.

In mapping units 171C2 and 171D2, the thickness of the A horizon is less than the range defined for the series, but this difference does not significantly alter the usefulness or behavior of the soils.

Catlin soils are on a landscape with Tama and Parr soils. They differ from Tama soils because the lower part of their subsoil formed in till, and, and they differ from Parr soils because of their subsoil formed in loess.

Catlin silt loam, 2 to 4 percent slopes (171B).—This soil has the profile described as representative for the series. It is on crests of irregular divides between areas of more sloping Catlin soils.

Included in mapping are small areas of soils that have a clay loam subsoil at a depth of less than 40 inches. Also included are small areas where slopes are less than 2 percent and more than 4 percent.

This soil is suited to crops commonly grown in the county. Erosion is a hazard. Terracing, contouring, and grassed waterways help to control erosion. If this soil is properly managed, it is suited to intensive cultivation. Management group IIe–2.

Catlin silt loam, 4 to 7 percent slopes, eroded (171C2).—This is the most extensive Catlin soil in the county. It occupies short slopes along drainageways or narrow, irregular divides between areas of more sloping Catlin soils. This soil has a thinner surface layer than the soil described as representative for the series. The present surface layer is a mixture of the original dark-colored surface layer and part of the upper subsoil. The thickness of the surface layer is about equal to the depth of plowing.

Included in mapping are small areas of soils that have a clay loam subsoil at a depth of less than 40 inches. Also included is a small acreage of Catlin soils that have a thicker surface layer than this soil, and small areas where a surface layer consists almost entirely of dark yellowish-brown subsoil material.

This soil is suited to crops commonly grown in the county. Erosion is a hazard. Unless protected from further erosion, this soil is not suited to intensive cultivation. Terracing, contouring, minimum tillage, conservation of residue, and use of grassed waterways help to control erosion. Management group IIe–2.

Catlin silt loam, 7 to 12 percent slopes, eroded (171D2).—This soil is on short slopes along drainageways. The present surface layer is composed of the original dark-colored surface layer and part of the upper subsoil. The surface layer and subsoil layer are thinner than those described as representative for the series.

Included in mapping are small areas of soils that have a clay loam subsoil at a depth less than 40 inches. Also included are small areas where the surface layer consists almost entirely of dark yellowish-brown subsoil material.

This soil is suited to the crops commonly grown in the county. Erosion is a hazard. As a result of erosion, the surface layer is low in fertility, less friable, and more difficult to keep in good tilth. Terracing, contouring, minimum tillage, conservation of residue, and use of grassed waterways help to control erosion, improve tilth, and maintain fertility. Management group IIIe–2.

Clarksdale Series

The Clarksdale series consists of somewhat poorly drained, nearly level soils. These soils are mainly on the uplands, but some occupy stream terraces. They formed in loess more than 60 inches thick under mixed prairie grasses and hardwood trees.

In a representative profile, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is grayish-brown and dark grayish-brown silt loam about 4 inches thick. The subsoil is about 32 inches thick. The uppermost 4 inches of this is dark grayish-brown light silty clay loam mottled with yellowish brown; the next 19 inches is dark-brown silty clay loam mottled with yellowish brown; and the lower 9 inches is mixed yellowish-brown and light brownish-gray light silty clay loam. The underlying material is mixed yellowish-brown and light brownish-gray silt loam.

Clarksdale soils are moderate in organic-matter content and moderate to high in natural fertility. They have moderately slow permeability and very high available water capacity.

Almost all areas of the Clarksdale soils are cultivated. These soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Clarksdale silt loam, in a cultivated field about 1.5 miles north of Lincoln, 405 feet south and 225 feet west of the center of sec. 18, T. 20 N., R. 2 W.:

Ap—0 to 8 inches, very dark brown (10YR 2/2) or very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A2—8 to 12 inches, grayish-brown (10YR 5/2) and dark grayish-brown (10YR 4/2) silt loam; very dark grayish-brown (10YR 3/2) coatings and many light-gray silt coatings (10YR 7/1) when dry; moderate, fine, granular structure; friable; slightly acid; clear, smooth boundary.

B1—12 to 16 inches, dark grayish-brown (10YR 4/2) light silty clay loam; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; very dark gray (10YR 3/1) and very dark grayish-brown (10YR 3/2) coatings; many light-gray (10YR 7/1 when dry) silt coatings; moderate, fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21t—16 to 24 inches, dark-brown (10YR 4/3) heavy silty clay loam; thin, continuous, dark grayish-brown (10YR 4/2) clay films; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B22t—24 to 35 inches, dark-brown (10YR 4/3) heavy silty clay loam or medium silty clay loam; thin, continuous, dark grayish-brown (10YR 4/2) and dark-gray (10YR 4/1) clay films; common medium, prominent, yellowish-brown (10YR 5/6) mottles, and few, medium, prominent, light brownish-gray (10YR 6/2) mottles; few black (10YR 2/1) iron and manganese concretions; moderate, coarse subangular blocky structure; firm; medium acid; clear, smooth boundary.

B3—35 to 44 inches, mixed yellowish-brown (10YR 5/6) and light brownish-gray (10YR 6/2) light silty clay loam; patchy black (10YR 2/1) and dark-gray (10YR 4/1) clay films; common, medium, prominent, strong-brown (7.5YR 5/8) mottles; few dark reddish-brown (5YR 2/2) iron and manganese concretions; weak, coarse, subangular blocky structure; friable; neutral; clear, smooth boundary.

C—44 to 60 inches, mixed yellowish-brown (10YR 5/6) and light brownish-gray (10YR 6/2) silt loam; many, coarse, distinct, yellowish-brown (10YR 5/8) mottles; massive; friable; calcareous.

Color of the Ap horizon ranges from very dark brown (10YR 2/2) to very dark gray (10YR 3/1), and thickness ranges from 6 to 10 inches. Color of the A2 horizon is grayish brown (10YR 5/2) to dark gray (10YR 4/1), and thickness ranges from 3 to 6 inches. Texture of the subsoil is centered on heavy silty clay loam, but it ranges from light silty clay loam to light silty clay.

Clarksdale soils are in patterns with Keomah, Clinton, and Ipava soils. Clarksdale soils are similar to Keomah soils but have a darker colored surface layer. They are darker colored and have poorer natural drainage than Clinton soils. Clarksdale soils have drainage similar to the Ipava soils, but they have a thinner, lighter colored surface layer. They have a grayish-brown subsurface layer, but the Ipava soils do not.

Clarksdale silt loam (257).—This is the only Clarksdale soil mapped in the county. It occupies small, irregularly shaped areas. Slope ranges from 0 to 3 percent.

Included in mapping are small areas of Ipava and Keomah soils.

This soil is suited to intensive cultivation and to crops commonly grown in the county. It has few limitations. Tile drains or shallow surface ditches readily remove excess water. Management group I–4.

Clinton Series

The Clinton series consists of well drained and moderately well drained, nearly level to steep soils on uplands. These soils formed in more than 60 inches of loess under mixed hardwood trees.

In a representative profile, the surface layer is dark-brown or brown silt loam about 7 inches thick. The yellowish-brown silt loam subsurface layer is about 3 inches thick. The subsoil is about 37 inches thick. The upper 24 inches of this layer is dark yellowish-brown silty clay loam mottled with light brownish-gray in the lower part. The lower 13 inches is yellowish-brown silt loam mottled with light brownish gray and strong brown. The underlying material is yellowish-brown silt loam (fig. 9).

Clinton soils are low in organic-matter content and moderate in natural fertility. They have moderately slow permeability and high or very high available water capacity. Unless previously treated, these soils need lime.

Most areas of Clinton soils are cultivated, but some are in pasture or woodland.

Representative profile of Clinton silt loam, 0 to 2 percent slopes, in a cultivated field about 4 miles east of Mid-

Figure 9.—Profile of a Clinton silt loam.

dletown, 33 feet south and 136 feet east of the NW. corner of the NW¼NE¼ sec. 14, T. 19 N., R. 4 W.:

Ap—0 to 7 inches, dark-brown (10YR 4/3) silt loam; moderate, very fine, granular structure; friable; medium acid; abrupt, smooth boundary.

A2—7 to 10 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, platy structure breaking to moderate, medium and coarse, granular structure; friable; very strongly acid; abrupt, smooth boundary.

B21t—10 to 14 inches, dark yellowish-brown (10YR 4/4) silty clay loam; light-gray (10YR 7/2 when dry) silt grains on faces of peds; few black (5YR 2/1) iron and manganese stains; moderate to strong, very fine and fine, subangular blocky structure; firm; very strongly acid; clear, smooth boundary.

B22t—14 to 21 inches, dark yellowish-brown (10YR 4/4) heavy silty clay loam; thin, continuous, dark yellowish-brown (10YR 4/4) clay films; moderate and strong, fine and medium, subangular blocky structure; firm; very strongly acid; clear, smooth boundary.

B23t—21 to 28 inches, dark yellowish-brown (10YR 4/4) heavy silty clay loam; thin, continuous, dark-brown (10YR 4/3) clay films; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; few black (5YR 2/1) iron and manganese concretions; weak, medium, prismatic structure breaking to moderate, coarse, subangular blocky structure; firm; very strongly acid; clear, smooth boundary.

B24t—28 to 34 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, discontinuous, dark-brown (10YR 4/3) clay films; few, fine, distinct, light brownish-gray (10YR 6/2) mottles and common, fine, distinct, strong-brown (7.5YR 5/8) mottles; few black (5YR 2/1) iron and manganese concretions; moderate, coarse, prismatic structure; firm; very strongly acid; clear, smooth boundary.

B3—34 to 47 inches, yellowish-brown (10YR 5/6) heavy silt loam; patchy dark-brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) coatings; common, medium, distinct, strong-brown (7.5YR 5/8) mottles and few, fine, distinct, light brownish-gray (10YR 6/2) mottles; few black (5YR 2/1) iron and manganese concretions and reddish-yellow (5YR 6/8) iron and manganese stains; weak, coarse, prismatic structure; friable; very strongly acid; clear, smooth boundary.

C1—47 to 55 inches, yellowish-brown (10YR 5/4 and 5/8) silt loam; abundant light-gray (10YR 7/2 when dry) silt grains; massive; friable; strongly acid; gradual, smooth boundary.

C2—55 to 60 inches, yellowish-brown (10YR 5/5) silt loam; common, fine, distinct, light brownish-gray (2.5Y 6/2) mottles and few, fine, distinct, yellowish-brown (10 YR 5/8) mottles; massive; friable; strongly acid.

Color of the Ap horizon is dark grayish brown (10YR 4/2) to dark brown (10YR 4/3). Texture ranges from silt loam to silty clay loam, and thickness ranges from 4 to 8 inches. In most areas of eroded soils, the A2 horizon is mixed with the Ap horizon. Where the A2 horizon is present, it ranges from dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4) and is 3 to 7 inches thick. Texture of the B horizon is centered on heavy silty clay loam, but it ranges from light silty clay loam to silty clay. Where this horizon is silty clay, the material is generally in thin layers.

In mapping unit 18E2, the subsoil contains less clay than the range defined for the series.

Clinton soils are in patterns with the Keomah and Rushville soils in the western and southern parts of the county, and they are with the Birkbeck, Miami, and Russell soils in the northeastern part of the county. Clinton soils have better natural drainage than Keomah and Rushville soils. The subsoil of Clinton soils formed in loess, whereas part of the subsoil of Birkbeck, Miami, and Russell soils formed in glacial till.

Clinton silt loam, 0 to 2 percent slopes (18A).—This soil has the profile described as representative for the series. It occupies narrow and broad, irregularly shaped areas on the uplands. A large acreage of this soil is in Corwin Township.

Included in mapping are small areas of Keomah soils and Clinton silt loam, 2 to 4 percent slopes. Small wet areas less than one acre in size are shown by a conventional symbol on the soil map.

This soil is suited to the crops commonly grown in the county. Low fertility, poor tilth, and susceptibility to crusting are limitations. Erosion is not a hazard. Additions of organic matter improve tilth and increase fertility. Management group I–1.

Clinton silt loam, 2 to 4 percent slopes (18B).—This soil occupies irregular divides between areas of more sloping Clinton soils on the uplands. It also occupies gentle side slopes surrounded by more nearly level areas and is on gentle side slopes at the heads of drainageways. In cultivated areas the subsurface layer is mixed with the surface layer. In some places the subsoil is mottle free and thinner than that of the soil described in the representative profile.

Included in mapping is a small acreage of eroded soils. Sand and wet areas less than one acre in size are shown by conventional symbols on the soil map.

This soil is suited to the crops commonly grown in the county. Erosion is a hazard. Low fertility, poor tilth, and susceptibility to crusting are limitations. Erosion control measures are needed to reduce soil losses. Additions of organic matter improve tilth and increase fertility. Some irregularly shaped areas are in pasture or woodland. If properly managed, this soil is suited to intensive cultivation. Management group IIe–1.

Clinton silt loam, 4 to 7 percent slopes, eroded (18C2).—This soil occupies short side slopes along drainageways on the uplands. In some places in the southern part of the county, it is on uniform, long slopes on morainal ridges. Thickness of the surface layer is about equal to the depth of plowing. Plowing has mixed part of the upper subsoil with the original surface layer and subsurface layer. The subsoil is thinner than that described in the representative profile for the series. In some places it is not mottled.

Included in mapping are small areas where the surface layer is similar to that in the representative profile. Also included are small areas where the surface layer consists almost entirely of dark yellowish-brown subsoil material. In these inclusions the surface layer contains more clay. Along Lake Fork east of Broadwell, there are inclusions of a soil that has clayey lakebed sediments below the subsoil.

This Clinton soil is suited to the crops commonly grown in the county. Erosion is a hazard, and low fertility and poor tilth are limitations. If erosion is controlled, this soil is suited to intensive cultivation. Additions of organic matter improve tilth and increase fertility. Management group IIe–1.

Clinton silt loam, 7 to 12 percent slopes, eroded (18D2).—This soil is on uplands and typically occupies short side slopes of drainageways. In some places in the southern part of the county, it occupies slopes on morainal ridges. Thickness of the surface layer is about equal to the depth of plowing. The present surface layer is made up of subsoil material mixed with the original surface layer and subsurface layer. The subsoil is thinner than that described in the representative profile, and in most places it is free of mottles.

Included in mapping are small areas that are calcareous at a depth of less than 40 inches, areas where the lower part of the subsoil formed in glacial till, and areas that have clayey lakebed sediments below the subsoil. Also included are small areas of a soil that is only slightly eroded and areas that are severely eroded.

This soil is suited to the crops commonly grown in the county. Erosion is a hazard. Low fertility and poor tilth are limitations. This soil is not suited to intensive cultivation. Erosion control measures are needed to reduce soil losses. Additions of organic matter improve tilth and increase fertility. Management group IIIe-1.

Clinton soils, 7 to 12 percent slopes, severely eroded (18D3).—These soils occupy short side slopes along drainageways. The surface layer is mostly subsoil material, and its texture ranges from silt loam to silty clay loam. Its thickness is about equal to the depth of plowing. The subsoil is thinner than that of the representative profile, and in most places it is not mottled.

Included in mapping are small areas that have calcareous material at a depth of less than 40 inches and areas where the lower part of the subsoil formed in glacial till. Also included is a small acreage of soil, along Lake Fork east of Broadwell, that has clayey lakebed sediments below the subsoil.

These Clinton soils are suited to small grains and hay, but they are of limited use for row crops. Erosion is a hazard. Fertility is low and tilth is poor. These soils are not suited to intensive cultivation. Management practices are needed to reduce soil and water losses, supply organic matter, and improve tilth. Areas of these soils used for permanent pasture need to be seeded to adapted grasses and legumes. Management group IVe-1.

Clinton silt loam, 12 to 18 percent slopes, eroded (18E2).—This soil occupies short, steep side slopes along drainageways and slopes facing bottom lands. Its profile is shallower than the profile described as representative for the series. The subsoil contains less clay and in most places is not mottled. This soil is included in the Clinton series, however, because its total acreage is small and it is similar to other Clinton soils in morphology, composition, and behavior.

Included in mapping are small areas of soils in which the lower part of the subsoil formed in glacial till. Also included are small areas that are only slightly eroded and areas that are severely eroded.

This soil is suited to crops commonly grown in the county. It is either cultivated or in pasture. Erosion is a hazard, and fertility is a limitation. The soil is too steep for intensive cultivation, but it is used for occasional row cropping in some places. It is suited to permanent pasture, small grain, and hay. The main management needs are control of erosion and improvement of fertility. Management group IVe-1.

Denny Series

The Denny series consists of poorly drained soils. These soils occupy nearly level areas and depressions on uplands and stream terraces. They are in many places in the county, but the total acreage is small. They formed in loess more than 60 inches thick under mixed prairie grasses.

In a representative profile, the surface layer is very dark grayish-brown silt loam about 9 inches thick. The subsurface layer is grayish-brown silt loam about 8 inches thick. The subsoil, about 39 inches thick, is mixed gray, light brownish gray, and yellowish brown. Its upper 11 inches is silty clay, and the lower 28 inches is silty clay loam. The underlying material is light brownish-gray silt loam mottled with yellowish brown (fig. 10).

Denny soils are moderate in organic-matter content and natural fertility. They have slow permeability and high available water capacity.

Most areas of the Denny soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Denny silt loam, in a cultivated field about 2 miles south-southeast of New Holland, 165 feet west and 66 feet south of the NW. corner of NW¼ NE¼ sec. 21, T. 20 N., R. 4 W.:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, very fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A1—7 to 9 inches, very dark gray (10YR 3/1) silt loam; dark grayish-brown (10YR 4/2) splotches; numerous light-

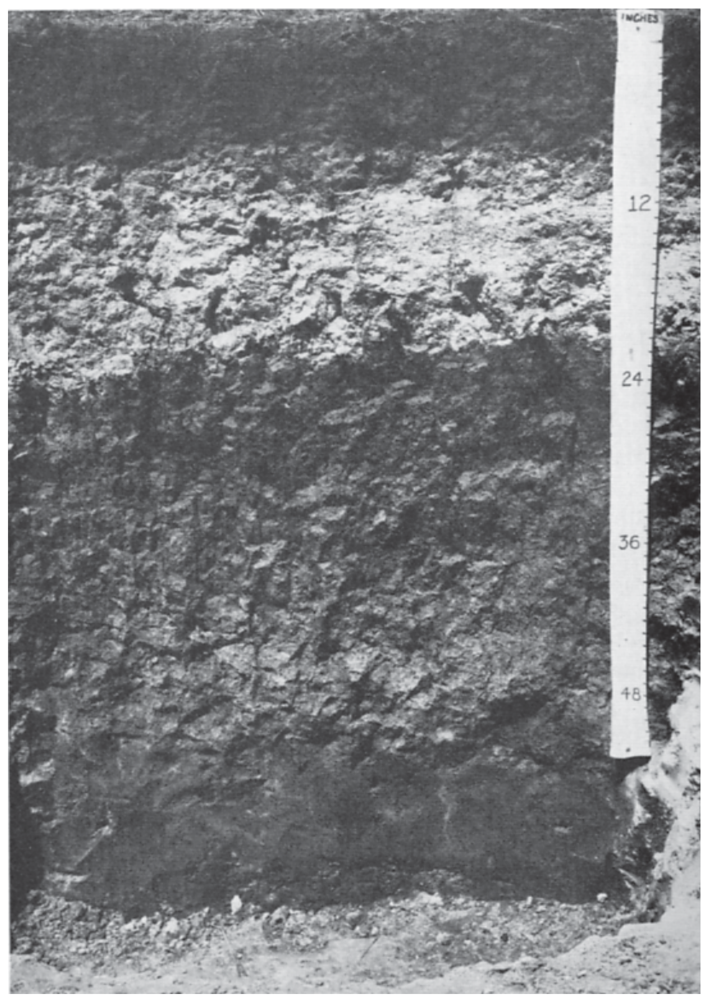

Figure 10.—**Profile of Denny silt loam.**

gray (10YR 7/1 when dry) silt grains; moderate, thin and medium, platy structure; friable; medium acid; clear, smooth boundary.

A2—9 to 17 inches, grayish-brown (10YR 5/2) silt loam; patchy, very dark gray (10YR 3/1) organic films; numerous white (10YR 8/1 when dry) silt grains; moderate, thin, platy structure; friable; medium acid; clear, smooth boundary.

B21tg—17 to 28 inches, dark grayish-brown (2.5Y 4/2) silty clay; thick, continuous, black (10YR 2/1) clay films; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, prismatic structure where undisturbed, breaking to strong, coarse, subangular blocky structure where disturbed; firm; medium acid; clear, smooth boundary.

B22tg—28 to 36 inches, 60 percent mixed gray or light-gray (10YR 6/1) and 40 percent yellowish-brown (10YR 5/6) heavy silty clay loam; thick, patchy, very dark gray (10YR 3/1) and a few, patchy, black (10YR 2/1) clay films; moderate, medium, prismatic structure where undisturbed, breaking to strong, coarse, subangular blocky structure where disturbed; firm; medium acid; clear, smooth boundary.

B23tg—36 to 48 inches, 60 percent mixed light brownish-gray (10YR 6/2) and 40 percent yellowish-brown (10YR 5/6) silty clay loam; thick, discontinuous, dark-gray (10YR 4/1) and very dark gray (10YR 3/1) clay films; moderate, coarse, prismatic structure; firm; medium acid; clear, smooth boundary.

B3g—48 to 56 inches, 60 percent mixed light brownish-gray (10YR 6/2) and 40 percent yellowish-brown (10YR 5/6) light silty clay loam; thin, discontinuous, very dark gray (10YR 3/1) clay films; weak, coarse, prismatic structure; firm; medium acid; clear, smooth boundary.

Cg—56 to 60 inches, light brownish-gray (10YR 6/2) heavy silt loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; friable; slightly acid.

Color of the Ap and A1 horizons is very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). The combined thickness of these horizons ranges from 6 to 9 inches. The A2 horizon is grayish brown (10YR 5/2) to gray (10YR 5/1) and is 6 to 15 inches thick. Texture of the B22 and B23 horizons is centered on heavy silty clay loam, but it ranges from light silty clay loam to light silty clay.

Denny soils are in a landscape with Ipava and Tama soils. They are more poorly drained and contain more clay in the subsoil than Ipava and Tama soils. Denny soils also have a distinctive gray subsurface layer that is lacking in the Ipava and Tama soils.

Denny silt loam (45).—This is the only Denny soil mapped in the county. It typically occupies depressions that are either somewhat circular or long and narrow. In some places on stream terraces, it occupies large nearly level areas. Slope is less than 2 percent. This soil is easily identified in the landscape because it shows as a gray area surrounded by the darker colored soils.

Included in mapping are small areas of some soils that are similar to this one but have a thicker subsurface layer, some that have a weakly expressed subsurface layer, and some that have a subsoil that contains less clay than is typical for the Denny series.

If this soil is adequately drained and fertilized, it is suited to the crops commonly grown in the county. Wetness is the main limitation. Runoff is slow or ponded because natural outlets are not adequate. Artificial drainage is needed if this soil is to be productive. Tile drains do not function well, because of slow permeability, but tile inlets or shallow surface ditches can be used to drain this soil. The surface layer crusts easily. Additions of organic matter are needed to improve tilth. Management group IIw-3.

Dickinson Series

The Dickinson series consists of well drained and somewhat excessively drained, nearly level to strongly sloping soils. These soils are mostly on the uplands but, in some places, are on stream terraces. They are common in the northwestern part of the county, but some areas are in other parts of the county. They formed under mixed prairie grasses in more than 60 inches of wind-deposited sand.

In a representative profile, the surface layer is very dark grayish-brown sandy loam about 16 inches thick. The subsoil is dark-brown and dark yellowish-brown sandy loam about 27 inches thick. The underlying material is dark yellowish-brown, loose sand.

Dickinson soils are moderate in organic-matter content and natural fertility. They have moderately rapid permeability and have low available water capacity.

Nearly all areas of Dickinson soils are cultivated. These soils are not so well suited to corn, soybeans, and oats as they are to wheat, grasses, and legumes.

In Logan County, Dickinson soils are so closely intermingled with Onarga soils that they were mapped in complexes with those soils.

Representative profile of Dickinson sandy loam from an area of Dickinson-Onarga sandy loams, 2 to 7 percent slopes, in a cultivated field about 2 miles northeast of Middletown, 495 feet east and 51 feet north of the center of sec. 5, T. 19 N., R. 4 W.:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) sandy loam; weak, fine, granular structure; friable; medium acid; abrupt, smooth boundary.

A1—8 to 16 inches, very dark grayish-brown (10YR 3/2) sandy loam; weak, fine, granular structure; friable; medium acid; gradual, smooth boundary.

B1—16 to 22 inches, dark-brown (10YR 3/3) sandy loam; some very dark grayish-brown (10YR 3/2) splotches; weak, fine, subangular blocky structure; friable; medium acid; gradual, smooth boundary.

B21—22 to 30 inches, dark yellowish-brown (10YR 4/4) sandy loam; some dark yellowish-brown (10YR 3/4) splotches; weak, fine, subangular blocky structure; friable; medium acid; gradual, smooth boundary.

B22—30 to 37 inches, dark yellowish-brown (10YR 4/4) sandy loam; some dark-brown (10YR 4/3) splotches; weak, fine and medium, subangular blocky structure; friable; medium acid; gradual, smooth boundary.

B3—37 to 43 inches, dark yellowish-brown (10YR 4/4) light sandy loam or loamy sand; a few dark-brown (10YR 4/3) splotches; weak, medium, subangular blocky structure; friable; medium acid; gradual, smooth boundary.

C—43 to 60 inches, dark yellowish-brown (10YR 4/6) sand; repeating, thin (½ to ¾ inch), dark yellowish-brown (10YR 4/4) bands of light sandy loam or sandy loam; mostly single grain, but massive in bands; mostly loose, but friable in bands; slightly acid.

Color of the Ap and A1 horizons is very dark brown (10YR 2/2) to dark brown (10YR 3/3). Combined thickness of these horizons ranges from 10 to 20 inches. Texture of the B horizon is typically sandy loam, but thin layers of loamy sand are included. Depth to loose sand is less than 45 inches.

In mapping units 974C2 and 974D2, the combined thickness of the Ap and A1 of Dickinson is thinner than the defined range for the series. This difference does not alter the usefulness or behavior of the soils.

Dickinson soils are next to Onarga soils on the landscape. Broadwell and Lawndale soils are nearby. Dickinson soils have less clay in the B2 horizon than Onarga soils. They contain more sand in the surface layer and subsoil than Broadwell and Lawndale soils.

Dickinson-Onarga sandy loams, 0 to 2 percent slopes (974A).—These soils occupy long narrow ridges and are in small isolated spots among areas of siltier soils. Dickinson sandy loam makes up 60 to 80 percent of the acreage in this mapping unit. Both soils have a thicker surface layer and subsoil than those described as representative for their respective series.

Included in mapping are small areas of similar soils that are somewhat poorly drained and small areas of loamy sand soils. Also included are small areas of soils that have a loam surface layer.

The soils in this complex are suited to the crops commonly grown in the county. Droughtiness is a limitation and soil blowing is a hazard. The soils are farmed in the same manner as soils nearby. Additions of organic matter help to retain moisture. Mulching or winter cover crops help to control soil blowing. Management group IIs–1.

Dickinson-Onarga sandy loams, 2 to 7 percent slopes (974B).—These soils have the profiles described as representative for their respective series. These soils are on long narrow ridges, small isolated knobs, and short side slopes of drainageways. Dickinson sandy loam makes up 60 to 80 percent of the acreage in this mapping unit.

Included in mapping are small areas of loamy sand soils and similar soils with a loam surface layer.

The soils in this complex are suited to crops commonly grown in the county but are not suited to intensive cultivation. They are droughty and subject to soil blowing and water erosion. Erosion control measures are needed to reduce soil and water losses. Additions of organic matter help to retain moisture. Mulching or winter cover crops help to control soil blowing. Management group IIIe–3.

Dickinson-Onarga sandy loams, 2 to 7 percent slopes, eroded (974C2).—These soils occupy long narrow ridges, small isolated knobs, and side slopes of drainageways. Thickness of the surface layer is about equal to the depth of plowing, but this layer is thinner than that described as representative for the respective series. About 60 percent of the acreage in this mapping unit is Onarga sandy loam, and nearly 40 percent is Dickinson sandy loam.

Included in mapping are small areas of loamy sand.

These soils are not suited to intensive cultivation. Erosion is a hazard, and droughtiness is a limitation. Erosion control measures and other management practices are needed to reduce soil and water losses. Management group IIIe–3.

Dickinson-Onarga sandy loams, 7 to 15 percent slopes, eroded (974D2).—These soils are on long narrow ridges and on short side slopes of drainageways. They have a thinner surface layer and subsoil than those described as representative for their respective series. Thickness of the surface layer is about equal to the depth of plowing. Dickinson sandy loam makes up 60 to 80 percent of the acreage in this mapping unit.

Included in mapping are small areas of soils that have a thicker surface layer and small areas of loamy sand.

These soils are not suited to intensive cultivation. Erosion is a hazard, and droughtiness is a limitation. Erosion control measures and other management practices are needed to reduce soil and water losses. Additions of organic matter help to improve tilth and retain moisture. Management group IIIe–3.

Drummer Series

The Drummer series consists of poorly drained, nearly level soils. These soils occupy low stream terraces in the western part of the county along Salt Creek. They are also in an outwash area in the northwestern part of the county. They formed under slough grasses and sedges in silty water-laid material 40 to 60 inches thick and the underlying stratified loamy outwash.

In a representative profile, the surface layer is black silty clay loam about 17 inches thick. The subsoil is about 37 inches thick and has a mixture of colors that include dark grayish brown, very dark gray, gray, olive brown, and yellowish brown. The upper 30 inches of the subsoil is silty clay loam, and the lower 7 inches is loam. The underlying material, to a depth of 60 inches, is mixed gray and brown loam.

Drummer soils are high in organic-matter content and natural fertility. They have moderate permeability and very high available water capacity.

Most areas of the Drummer soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Drummer silty clay loam, in a cultivated field about 1.5 miles southwest of New Holland, 1,280 feet north and 65 feet east of the SW. corner of sec. 19, T. 20 N., R. 4 W.:

Ap—0 to 8 inches, black (10YR 2/1) silty clay loam; yellowish-red (5YR 5/8) iron and manganese concretions; weak, fine and very fine, granular structure; friable; medium acid; abrupt, smooth boundary.

A11—8 to 14 inches, black (10YR 2/1) silty clay loam; moderate, fine, granular structure; friable; slightly acid; clear, smooth boundary.

A12—14 to 17 inches, very dark brown (10YR 2/2) silty clay loam; few yellowish-red (5YR 5/8) iron and manganese concretions; weak, very fine, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B1—17 to 21 inches, very dark grayish-brown (10YR 3/2) silty clay loam; continuous, very dark gray (10YR 3/1) coatings; a few yellowish-red (5YR 5/8) iron and manganese concretions; moderate, very fine, subangular blocky structure; firm; slightly acid; clear, smooth boundary.

B21g—21 to 26 inches, olive-brown (2.5Y 4/4) silty clay loam; continuous, dark-gray (10YR 4/1) and very dark gray (10YR 3/1) clay films; few, fine, distinct, yellowish-brown (10YR 5/4) mottles; many dark reddish-brown (5YR 2/2) iron and manganese concretions; weak to moderate, fine, subangular blocky structure; firm; slightly acid; clear, smooth boundary.

B22g—26 to 39 inches, 70 percent yellowish-brown (10YR 5/8) and 30 percent gray (10YR 5/1) silty clay loam; discontinuous, gray (10YR 5/1) and dark gray (10YR 4/1) clay films; dark reddish-brown (5YR 2/2) iron and manganese concretions; weak, coarse, subangular blocky structure; firm; slightly acid; clear, smooth boundary.

B31g—39 to 47 inches, strong-brown (7.5YR 5/8) light silty clay loam; discontinuous, very dark gray (10YR 3/1) and dark-gray (10YR 4/1) clay films; dark reddish-brown (5YR 2/2) iron and manganese concretions; many, fine, distinct, gray (N 5/0) mottles; weak, very coarse, prismatic structure; friable; slightly acid; clear smooth boundary.

IIB32g—47 to 54 inches, mixed strong-brown (7.5YR 5/8) and gray (N 5/0) loam; a few, discontinuous, dark-gray (N 4/0) clay films; weak, coarse, subangular blocky structure; friable; slightly acid; gradual, smooth boundary.

IICg—54 to 60 inches, mixed strong-brown (7.5YR 5/8) and gray or light-gray (N 6/0) loam; massive; friable; neutral.

Color of the Ap and A1 horizons ranges from black (10YR 2/1) to very dark gray (10YR 3/1). Texture of these horizons is light silty clay loam to heavy silty clay loam, and the combined thickness ranges from 14 to 24 inches. Texture of the B2 horizon is centered on silty clay loam, but the lower part of the B3 horizon ranges from clay loam to sandy loam. Depth to the C horizon is 40 to 60 inches. Texture of the C horizon is loam, silt loam, and sandy loam.

Drummer soils are on landscapes with Brenton, Proctor, Elburn, and Plano soils. Drummer soils differ from these soils because they are more poorly drained and have more clay in the surface layer.

Drummer silty clay loam (152).—This is the only Drummer soil mapped in the county. In some places this soil occupies broad, irregularly shaped areas, and in other places it is in narrow channels. Slope is less than 2 percent.

Included in mapping are small areas of soils that are shallow over gravel. These inclusions are in long, narrow channels in a high terrace northwest of Burton View. Also included are small areas of Sable and Sawmill soils and small areas of silty overwash. Wet areas that are less than one acre in size are shown by a conventional symbol on the soil map.

This soil is suited to crops commonly grown in the county. Wetness is a limitation. Runoff is slow or ponded. Tile drains and shallow surface ditches improve drainage. The surface layer becomes cloddy if worked when the moisture content is too high. Careful management is required where this soil is intensively cropped. Management group IIw–1.

Elburn Series

The Elburn series consists of somewhat poorly drained, nearly level soils. These soils occupy slopes mainly on stream terraces, but they are also in the uplands. They formed under mixed prairie grasses in loess or silty water-laid material 40 to 60 inches thick and in the underlying stratified loamy outwash.

In a representative profile, the surface layer is black silt loam about 13 inches thick. The subsoil is about 47 inches thick. In sequence from the top, the upper 12 inches is dark-brown silty clay loam, the next 10 inches is dark yellowish-brown silty clay loam mottled with yellowish brown, the next 9 inches is mixed yellowish-brown and olive-brown silty clay loam, and the lower 16 inches is mixed strong-brown, brownish-gray, yellowish-brown, and dark grayish-brown sandy loam and loam. The underlying material is light brownish-gray and dark grayish-brown sandy loam and loam.

Elburn soils are high in organic-matter content and natural fertility. They have moderate permeability and high or very high available water capacity.

Most areas of Elburn soils are cultivated. These soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Elburn silt loam, in a cultivated field about 0.5 mile east of Lawndale, 1,320 feet north and 50 feet west of the SE. corner of sec. 2, T. 20 N., R. 2 W.:

Ap—0 to 7 inches, black (10YR 2/1) silt loam; moderate, very fine and fine, granular structure; friable; neutral; abrupt, smooth boundary.

A1—7 to 13 inches, black (10YR 2/1) silt loam; moderate, fine, granular structure; friable; neutral; clear, smooth boundary.

B1—13 to 18 inches, dark-brown (10YR 4/3) light silty clay loam; black (10YR 2/1) organic coatings; moderate, very fine and fine, subangular blocky structure; friable; neutral; clear, smooth boundary.

B21t—18 to 25 inches, dark-brown (10YR 4/3) silty clay loam; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; thin, discontinuous, dark grayish-brown (10YR 4/2) clay films; few very dark brown (10YR 2/2) clay films; few black (5YR 2/1) iron and manganese concretions; moderate, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B22t—25 to 35 inches, dark yellowish-brown (10YR 4/4) silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; thin, discontinuous, dark grayish-brown (10YR 4/2) clay films; patches of very dark gray (10YR 3/1) and black (10YR 2/1) clay films; a few black (5YR 2/1) iron and manganese concretions; weak, medium, prismatic structure, breaking to moderate, medium and coarse, subangular blocky structure; firm; slightly acid; clear, smooth boundary.

B31—35 to 44 inches, mixed yellowish-brown (10YR 5/8) and light olive-brown (2.5Y 5/4) light silty clay loam; patches of very dark gray (10YR 3/1) and dark grayish-brown (10YR 4/2) clay films; weak, coarse, prismatic structure, breaking to moderate, coarse, subangular blocky structure; friable; neutral; abrupt, smooth boundary.

IIB32—44 to 50 inches, mixed strong-brown (7.5YR 5/8) and light brownish-gray (10YR 6/2) heavy sandy loam; weak, coarse, subangular blocky structure and massive; friable; neutral; clear, smooth boundary.

IIB33—50 to 60 inches, mixed strong-brown (7.5YR 5/8), yellowish-brown (10YR 5/6), and dark grayish-brown (10YR 4/2), sticky sandy loam; bands of loam 1 inch to 2 inches thick; many pebbles throughout horizon; weak, coarse, subangular blocky structure and massive; friable; neutral.

Color of the Ap and A1 horizons ranges from black (10YR 2/1) to very dark brown (10YR 2/2), and thickness ranges from 10 to 16 inches. Texture of the B2 horizon is centered on silty clay loam, but texture of the IIB3 horizon ranges from clay loam to sandy loam. Depth to stratified loamy material is 40 to 60 inches.

Elburn soils are on a landscape with Plano, Tama, Brenton, and Muscatine soils. Elburn soils are somewhat poorly drained, but Tama and Plano soils are well drained and moderately well drained. Elburn soils are similar in drainage to Brenton soils, but no part of their subsoil above a depth of 40 inches formed in loamy outwash. Part of the subsoil of Elburn soils formed in loamy outwash, whereas the Muscatine soils have no outwash in the subsoil.

Elburn silt loam (198).—This is the only Elburn soil mapped in the county. It generally occupies small areas near more poorly drained soils, but in some places it occupies small areas surrounded by better drained soils. Slope ranges from 0 to 3 percent.

Included in mapping is a considerable acreage of soils that are similar to this soil except they have less clay in the subsoil. These inclusions are on broad, nearly level, low terraces near streams. Also included are small areas of Muscatine and Brenton soils.

This soil is well suited to the crops commonly grown in the county. It has few limitations and can be intensively cultivated. Runoff is slow, but tile drains can be used to improve drainage where needed. Management group I–4.

Elkhart Series

The Elkhart series consists of well-drained, moderately sloping and strongly sloping soils. These soils are common in the western and southwestern parts of the county. They formed under mixed prairie grasses in loess more than 60 inches thick on uplands.

In a representative profile, the surface layer is very dark grayish-brown silt loam about 10 inches thick. The subsoil is silty clay loam about 21 inches thick. The uppermost 5 inches is dark brown, the next 13 inches is dark yellowish brown, and the lower 3 inches is yellowish brown. The underlying material is yellowish-brown silt loam mottled with strong brown and light gray.

Elkhart soils are high in organic-matter content and natural fertility. They have moderate permeability and high available water capacity.

Most areas of Elkhart soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Elkhart silt loam, 4 to 7 percent slopes, eroded, in a cultivated field about 0.5 mile south of Broadwell, 330 feet north from road culvert and 72 feet east from center of road in the NE¼SE¼ sec. 32, T. 19 N., R. 3 W.:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; weak and moderate, fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A1—8 to 10 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable; slightly acid; clear, smooth boundary.

B1—10 to 15 inches, dark-brown (10YR 3/3) light silty clay loam; weak and moderate, fine and very fine, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B21t—15 to 22 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, continuous, very dark grayish-brown (10YR 3/2) clay films; moderate, fine, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B22t—22 to 28 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, discontinuous, dark-brown (10 YR 3/3) clay films; moderate, fine and medium, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B3—28 to 31 inches, yellowish-brown (10YR 5/4) light silty clay loam; thin, patchy, brown (10YR 4/3) clay films; few, fine, black (5YR 2/1) iron and manganese concretions; weak and moderate, medium and coarse, subangular blocky structure; friable; neutral; clear, smooth boundary.

C—31 to 60 inches, yellowish-brown (10YR 5/4) silt loam; common, fine, distinct, strong-brown (7.5YR 5/8) mottles and many, medium, distinct, light-gray (10YR 6/1) mottles; massive; friable; calcareous, moderately alkaline.

Color of the Ap and A1 horizons ranges from very dark brown (10YR 2/2) to dark brown (10YR 3/3). Texture of these horizons ranges from silt loam to light silty clay loam, and their combined thickness is 10 to 12 inches. In places all of the A1 horizon has been mixed into the Ap horizon by plowing. Color of the B1 horizon is very dark grayish brown (10YR 3/2) to dark brown (10YR 4/3), and texture ranges from silt loam to light silty clay loam. Thickness of the B2 horizon is 8 to 20 inches. Depth to the C horizon ranges from 24 to 40 inches.

Elkhart soils are on a landscape with Tama, Tallula, and Bold soils. Elkhart soils are calcareous nearer the surface than Tama soils. They have a silty clay loam subsoil, but Tallula and Bold soils have a silt loam subsoil.

Elkhart silt loam, 4 to 7 percent slopes, eroded (567C2).—This soil has the profile described as representative for the series. It occupies short side slopes of drainageways. Plowing has mixed some subsoil material with the original surface layer.

Included in mapping are small areas of soils that have a dark yellowish-brown surface layer. Those soils are more clayey and less friable than this soil. Also included are some areas of Tallula-Bold silt loams and small areas of soils that have a thicker and darker colored surface layer than that of this soil.

This soil is suited to the crops commonly grown in the county. Erosion is a hazard. Low fertility and poor tilth are limitations. This soil is not suited to intensive cultivation unless it is protected from further erosion. Shape and shortness of slope restrict the use of some erosion control practices. Those practices that can be adapted will reduce further soil losses. Additions of organic matter help to improve and maintain tilth and fertility. Management group IIe–2.

Elkhart silt loam, 7 to 12 percent slopes, eroded (567D2).—This soil occupies short side slopes of drainageways. It has a profile similar to the one described as representative for the series, but the subsoil is thinner and calcareous silt loam is closer to the surface.

Included in mapping are small areas of soil that have a dark yellowish-brown surface layer. Those soils are more clayey and less friable than this soil. Also included are small areas of Tallula-Bold silt loams.

This soil is suited to the crops commonly grown in the county. Erosion is a hazard. Low fertility and poor tilth are limitations. This soil is not suited to intensive cultivation. Erosion control practices reduce soil losses, but shape and shortness of slope limit the use of some practices. Conservation of residue helps to improve tilth and increase fertility. Management group IIIe–2.

Fayette Series

The Fayette series consists of well-drained, nearly level soils. These soils occupy areas on stream terraces, mostly in the northeastern part of the county along Sugar and Kickapoo Creeks. They formed under mixed hardwood trees in loess more than 60 inches thick.

In a representative profile, the surface layer is dark-brown silt loam about 8 inches thick. The subsurface layer is dark grayish-brown silt loam about 6 inches thick. The subsoil is dark-brown silty clay loam and silt loam about 40 inches thick. The underlying material to a depth of 60 inches is dark-brown silt loam.

Fayette soils are low in organic-matter content and moderate in natural fertility. They have moderate permeability and high or very high available water capacity. These soils need lime unless previously treated.

Almost all areas of Fayette soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Fayette silt loam, in a cultivated field about 2.5 miles west of Lincoln, 675 feet west and 125 feet south of the NE. corner of SE¼NW¼ sec. 33, T. 20 N., R. 3 W.:

Ap—0 to 8 inches, dark-brown (10 YR 4/3) silt loam; weak, very fine, granular structure; friable; neutral; abrupt, smooth boundary.

A2—8 to 14 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, platy structure; friable; neutral; clear, smooth boundary.

B1—14 to 19 inches, dark-brown (7.5YR 4/4) heavy silt loam; light-gray (10YR 7/1) silt grains on faces of peds; weak, very fine, subangular blocky structure; friable; neutral; clear, smooth boundary.

B21t—19 to 31 inches, dark-brown (7.5YR 4/4) silty clay loam; thin, continuous, dark-brown (7.5YR 4/4) clay films; small, black (5YR 2/1) iron and manganese concretions; moderate, very fine, subangular blocky structure; firm; slightly acid; gradual, smooth boundary.

B22t—31 to 42 inches, dark-brown (7.5YR 4/4) silty clay loam; thin, continuous, dark-brown (7.5YR 4/4) clay films; small, black (5YR 2/1) iron and manganese concretions; moderate, fine, subangular blocky structure; firm; slightly acid; clear, smooth boundary.

B3—42 to 54 inches, dark-brown (7.5YR 4/4) heavy silt loam; thin, discontinuous, dark-brown (7.5YR 4/4) clay films; few, fine, distinct, grayish-brown (10YR 5/2) mottles and few, fine, distinct, yellowish-red (5YR 4/6) mottles; few dark reddish-brown (5YR 3/4) iron and manganese concretions; weak, coarse, subangular blocky structure; friable; medium acid; gradual, smooth boundary.

C—54 to 60 inches, dark-brown (7.5YR 4/4) silt loam; common, medium, distinct, strong-brown (7.5YR 5/8) mottles and few, coarse, distinct, light brownish-gray (10YR 6/2) mottles; few dark reddish-brown (5YR 2/2) iron and manganese stains; massive; friable; medium acid.

Color of the Ap horizon ranges from dark grayish brown (10YR 4/2) to dark brown (10YR 4/3), and thickness is 6 to 8 inches. Color of the A2 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3), and thickness is 5 to 8 inches. Texture of the B horizon is centered on silty clay loam, but it ranges from heavy silt loam to thin horizons of heavy silty clay loam.

Fayette soils are on a landscape with St. Charles and Thebes soils. Fayette soils are similar in natural drainage to St. Charles and Thebes soils, but they differ from those soils because no part of their subsoil formed in the underlying stratified sandy material.

Fayette silt loam (280).—This is the only Fayette soil mapped in the county. It is nearly level and occupies broad areas on stream terraces. Slope ranges from 0 to 3 percent.

Included in mapping are small areas of St. Charles and Thebes soils.

This soil is suited to crops commonly grown in the county and can be intensively cultivated. Low fertility and poor tilth are the main limitations. Erosion is not a hazard, except in a few places where slopes are 2 to 3 percent. These areas are cropped the same as the more nearly level areas. Runoff is slow, but wetness is not a limitation. The surface layer is low in organic-matter content, and there is a tendency for crusts to form. Management group I–1.

Harpster Series

This series consists of poorly drained, nearly level soils that formed under slough grasses and sedges in loess more than 60 inches thick. These soils are calcareous because of the numerous shell fragments from snails that once were abundant in the shallow water that covered these soils. Most areas of these soils are in depressions, but some are in narrow bands surrounding areas of other soils in depressions. Harpster soils are throughout the county, but the total acreage is small.

In a representative profile, the surface layer is black silty clay loam about 16 inches thick. Many shell fragments and whole shells of snails are in this layer. The subsoil, about 19 inches thick, is dark-gray and gray silty clay loam mottled with light olive brown and yellowish brown. Some shell fragments are also in this layer. The underlying material, to a depth of 60 inches, is gray silt loam mottled with yellowish brown.

Harpster soils are high in organic-matter content and natural fertility but contain an excess of lime. They have moderate to moderately slow permeability and high available water capacity.

Nearly all areas of Harpster soils are cultivated. These soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Harpster silty clay loam in a cultivated field about 1.5 miles east of Burton View, 720 feet east of the SW. corner of NW¼ sec. 20, T. 20 N., R. 3 W.:

Apca—0 to 7 inches, black (10YR 2/1) silty clay loam; many shell fragments; moderate, very fine, granular structure; firm; calcareous; abrupt, smooth boundary.

A1ca—7 to 16 inches, black (10YR 2/1) silty clay loam; many shell fragments; moderate, fine and very fine, granular structure; firm; calcareous; clear, smooth boundary.

B1g—16 to 20 inches, very dark gray (10YR 3/1) silty clay loam; thin, continuous, black (10YR 2/1) organic films; common, fine, faint, yellowish-brown (10YR 5/6) and light olive-brown (2.5Y 5/6) mottles; weak and moderate, fine, subangular blocky structure; firm; calcareous; clear, smooth boundary.

B2g—20 to 28 inches, dark-gray (N 4/0) silty clay loam; thin, discontinuous, very dark gray (10YR 3/1) and some dark-gray (5Y 4/1) clay films; many, medium, prominent, light olive-brown (2.5Y 5/6) mottles; weak and moderate, fine, prismatic structure where undisturbed, breaking to moderate, medium, subangular blocky structure where disturbed; firm; calcareous; clear, wavy boundary.

B3g—28 to 35 inches, gray or light-gray (10YR 6/1) light silty clay loam; thin, discontinuous, gray (5Y 5/1) clay films; common, medium, prominent, yellowish-brown mottles (10YR 5/8) and few, fine, prominent, yellowish-brown (10YR 5/6) mottles; krotovinas 2½ inches in diameter filled with black (10YR 2/1) silty clay loam; weak, fine and medium, prismatic structure where undisturbed, breaking to weak, medium, subangular blocky structure where disturbed; firm; calcareous; clear, wavy boundary.

C1g—35 to 45 inches, mixed strong-brown (7.5YR 5/8) and gray or light-gray (10YR 6/1) silt loam; some gray (10YR 5/1) clay films that tongue into the horizon; many white (10YR 8/1) lime concretions; massive; friable; calcareous; gradual, smooth boundary.

C2g—45 to 60 inches, gray or light-gray (10YR 6/1) silt loam; few, medium, distinct, strong-brown (7.5YR 5/8) mottles and many, medium, distinct, yellowish-brown (10YR 5/6) mottles; few white (10YR 8/1) lime concretions; massive; friable; calcareous.

Color of the Ap and A1 horizons ranges from black (10YR 2/1) to very dark gray (10YR 3/1). Texture of these horizons ranges from heavy silt loam to silty clay loam, and the combined thickness is 12 to 18 inches. Depth to the C horizon ranges from 24 to 48 inches.

Harpster soils are on a landscape with Sable, Hartsburg, and Shiloh soils. Harpster soils differ from these soils mainly because they are calcareous throughout the profile.

Harpster silty clay loam (67).—This is the only Harpster soil mapped in the county. It occupies depressional areas of different size or is in narrow bands surrounding areas of other soils in depressions. Slope is less than 2 percent.

Included with this soil in mapping are small areas of Sable, Hartsburg, and Shiloh soils.

This soil is suited to the crops commonly grown in the county. Wetness and excess lime are limitations to management of this soil. Runoff is slow or ponded, and artificial drainage is needed. Tile drains and shallow surface ditches can be used to drain the soil, but outlets are difficult to obtain in some places. The effects of excess lime can be overcome by proper fertilization. The surface layer becomes cloddy if worked when too wet. Careful management is required where this soil is used intensively. Management group IIw–1.

Hartsburg Series

The Hartsburg series consists of poorly drained, nearly level soils. These soils are common on the uplands in the western and southwestern parts of the county. They formed under slough grasses and sedges in loess more than 60 inches thick.

In a representative profile, the surface layer is black silty clay loam about 17 inches thick. The subsoil is dark grayish-brown and gray silty clay loam mottled with yellowish brown, and it is about 17 inches thick. The underlying material, to a depth of 60 inches, is brownish-gray silt loam mottled with brown.

Hartsburg soils are high in organic-matter content and natural fertility. They have moderate permeability and high or very high available water capacity.

Nearly all the acreage of Hartsburg soils is cultivated. These soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Hartsburg silty clay loam, in a cultivated field about 4 miles southwest of Emden, 660 feet west and 40 feet north of the SE. corner of sec. 23, T. 21 N., R. 4 W.:

Ap—0 to 7 inches, black (10YR 2/1) silty clay loam; moderate, medium to fine, granular structure; slightly acid; clear, smooth boundary.

A1—7 to 12 inches, black (10YR 2/1) silty clay loam; moderate, medium and fine, granular structure; firm; slightly acid; clear, smooth boundary.

A3—12 to 17 inches, very dark gray (10YR 3/1) silty clay loam; few, fine, distinct, dark grayish-brown (2.5YR 4/2) mottles; moderate, medium, granular structure and weak, fine, subangular blocky structure; firm; neutral; clear, smooth boundary.

B1g—17 to 21 inches, ped interiors are dark grayish-brown, (2.5Y 4/2) to grayish-brown (2.5Y 5/2) silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/6 to 5/8) mottles; some very dark gray (10YR 3/1) organic coatings; weak, fine and medium, subangular blocky structure; krotovinas are filled with material from A horizon; firm; neutral; clear, smooth boundary.

B2g—21 to 30 inches, ped interiors are gray (5Y 5/1) to grayish-brown (2.5Y 5/2) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/8) to strong-brown (7.5YR 5/8) mottles; thin, continuous, dark grayish-brown (10YR 4/2 or 2.5Y 4/2) coatings on faces of peds and in worm channels and root pores; moderate, medium and coarse, subangular blocky structure; krotovinas are filled with material from A horizon; firm; few light-gray (10YR 7/1) lime concretions; slight effervescence; abrupt, wavy boundary.

B3g—30 to 34 inches, ped interiors are mixed light brownish-gray (2.5Y 6/2) and yellowish-brown (10YR 5/8) light silty clay loam to silt loam; thin, discontinuous, gray (N 5/0) to grayish-brown (2.5Y 5/2) coatings on faces of peds and in numerous root pores; very weak, coarse, subangular blocky structure; firm to friable; many light-gray (10YR 7/1) lime concretions; some black (5Y 2/1) iron and manganese concretions; krotovinas are filled with material from A horizon; violent effervescence among concretions, slight effervescence in fine earth; clear, wavy boundary.

Cg—34 to 60 inches. light brownish-gray (2.5Y 6/2) to grayish-brown (2.5Y 5/2) silt loam; many, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; friable; scattered light-gray (10YR 7/1) lime concretions; krotovinas are filled with material from A horizon; strong effervescence.

Color of the Ap, A1, and A3 horizons is black (10YR 2/1) to very dark gray (10YR 3/1), and texture is light to heavy silty clay loam. The combined thickness of these horizons ranges from 12 to 20 inches. Depth to calcareous material is 15 to 35 inches.

Hartsburg soils are mainly on a landscape with Sable and Ipava soils. They are similar to Sable soils in many ways, but they have free lime at some depth between 15 and 35 inches. Hartsburg soils have poorer drainage and more clay in the surface layer than Ipava soils.

Hartsburg silty clay loam (244).—This is the only Hartsburg soil mapped in the county. It is in nearly level areas or in large shallow depressions and has slopes that exceed 1 percent in only a few places.

Included in mapping are small areas of Harpster and Shiloh soils.

This soil is well suited to crops commonly grown in the county. Wetness is a limitation. Because this soil lies in a position somewhat lower than surrounding soils, it receives runoff and is often ponded for short periods of time. This soil becomes cloddy if worked when too wet. Tile drains and shallow surface drains can be used to improve drainage where needed. Management group IIw–1.

Hennepin Series

The Hennepin series consists of well-drained, steep and very steep soils. These soils are on uplands in the northeastern part of the county along Sugar Creek and Kickapoo Creek and in a few places along Salt Creek in Corwin Township. They formed under mixed hardwood trees in glacial till.

In a representative profile, the surface layer is dark grayish-brown loam about 6 inches thick. The subsoil is light olive-brown loam about 9 inches thick. The underlying material, to a depth of about 50 inches, is a light olive-brown loam.

Hennepin soils are low in organic-matter content and moderate in natural fertility. They have moderate permeability and moderate available water capacity.

Nearly all areas of Hennepin soils are in pasture or woodland, and the soils are suited to this use.

In Logan County, Hennepin soils were mapped only in an undifferentiated group with Miami soils.

Representative profile of Hennepin loam from an area of Hennepin and Miami soils, 18 to 60 percent slopes, in a pasture about 1.5 miles east of Union, 1,056 feet west from west bridge abutment and 369 feet south from road, 55 feet up from base of slope in the SW¼ sec. 9, T. 21 N., R. 2 W.:

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) loam; weak and moderate, very fine, granular structure; friable; many small till pebbles and stones; calcareous; clear, smooth boundary.

B—6 to 15 inches, light olive-brown (2.5Y 5/4) loam; weak, fine and medium, granular structure; friable; calcareous; clear, smooth boundary.

C—15 to 50 inches, light olive-brown (2.5Y 5/4) loam; massive; friable; calcareous; scattered, thin (1 inch) bands of sandy loam and silt loam.

Color of the A1 horizon ranges from dark grayish brown (10YR 4/2) to dark gray (10YR 4/1). Texture is typically loam but is silt loam in places. Thickness of the A1 horizon is 3 to 6 inches. Thickness of the B horizon is 3 to 12 inches. Calcareous till is within 15 inches of the surface.

Hennepin soils are next to Miami soils. Both soils formed in glacial till, but calcareous till is closer to the surface in the Hennepin soils. Hennepin soils have natural drainage similar to that of Hickory soils, which formed in glacial till on another landscape, but Hennepin soils have less clay in the B horizon and are shallower over calcareous till.

Hennepin and Miami soils, 18 to 60 percent slopes (964F).—These soils occur together without regularity in pattern and proportion, and there are areas of each large enough to be mapped separately if it were practical. Individual areas consist entirely of Hennepin soils, entirely of Miami soils, or some of both. These soils occupy side slopes of drainageways and short steep slopes facing bottom lands.

Included in mapping are areas of Hennepin soils that have an olive-brown surface layer and areas of Miami soils that have a dark grayish-brown surface layer and brown subsurface layer. Also included are small areas of Hennepin soils where slope is less than 18 percent.

The soils in this mapping unit are commonly used for pasture or woodland. Erosion is a hazard. Steepness of slope restricts the use of some management practices. Existing woodlands are of low quality. Management group VIIe–1.

Hickory Series

The Hickory series consists of well drained and moderately well drained, moderately steep to very steep soils. These soils are common on uplands along Salt Creek. They are also on uplands in a few places along Lake Fork. They formed under mixed hardwood trees in glacial till.

In a representative profile, the surface layer is dark grayish-brown loam about 3 inches thick. The subsurface layer is grayish-brown loam about 4 inches thick. The subsoil is dark-brown and yellowish-brown clay loam about 39 inches thick. The underlying material, to a depth of 60 inches, is yellowish-brown loam.

Hickory soils are low in organic-matter content and moderate in natural fertility. They have moderate permeability and high available water capacity.

Most areas of Hickory soils are used for pasture or woodland, to which the soils are well suited. A small acreage is cultivated.

In Logan County, Hickory soils were mapped only in an undifferentiated group with Sylvan soils.

Representative profile of Hickory loam from an area of Hickory and Sylvan soils, 15 to 50 percent slopes, eroded, in a woodland pasture about 2.5 miles southeast of Beason, 400 feet north and 159 feet east of the SW. corner of the SW¼ sec. 12, T. 19 N., R. 1 W.:

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) loam; moderate, fine, granular structure; friable; neutral; clear, smooth boundary.

A2—3 to 7 inches, grayish-brown (10YR 5/2) loam; dark grayish-brown (10YR 4/2) splotches; weak, fine, granular structure; friable; many till pebbles of various sizes; slightly acid; clear, smooth boundary.

B21t—7 to 15 inches, dark-brown (7.5YR 4/4) heavy clay loam; thin, continuous, dark-brown (7.5YR 4/4) clay films; moderate, fine, subangular blocky structure; firm; many till pebbles of various sizes; medium acid; clear, smooth boundary.

B22t—15 to 25 inches, dark yellowish-brown (10YR 4/4) heavy clay loam; thin, continuous, dark-brown (7.5YR 4/4) clay films; weak and moderate, medium, subangular blocky structure; firm; many till pebbles of various sizes; strongly acid; gradual, smooth boundary.

B31t—25 to 38 inches, yellowish-brown (10YR 5/4) clay loam; thin, discontinuous, dark-brown (7.5YR 4/4) clay films; dark-brown (7.5YR 3/2) clay in root channels; very dark gray (10YR 3/1) iron and manganese stains; weak, coarse, prismatic structure; firm; many till pebbles of various sizes; strongly acid; gradual, smooth boundary.

B32—38 to 46 inches, yellowish-brown (10YR 5/4) clay loam; thin, discontinuous, dark-brown (7.5YR 4/3) clay films; few, fine, distinct, gray or light-gray (5Y 6/1) mottles; a few, very dark gray (10YR 3/1) iron and manganese stains; weak, coarse, prismatic structure; friable; many till pebbles of various sizes; slightly acid; gradual, wavy boundary.

C—46 to 60 inches, yellowish-brown (10YR 5/4) loam; some thin, discontinuous, dark-brown (7.5YR 4/3) coatings on cleavage faces; massive but tends to cleave; friable; calcareous.

Color of the A1 horizon ranges from dark grayish brown (10YR 4/2) to dark brown (7.5YR 4/4). Texture of the A1 horizon is typically loam but ranges to clay loam; thickness is 3 to 6 inches. Color of the A2 horizon is dark grayish brown (10YR 4/2) to brown (10YR 5/3), and thickness ranges from 3 to 7 inches. In severely eroded areas, the A1 and A2 horizons have been removed. The B horizon is clay loam to gravelly clay loam, and its thickness ranges from 33 to 55 inches. Depth to the C horizon ranges from 40 to 60 inches.

Hickory soils are next to Sylvan soils. They are similar to Sylvan soils in natural drainage, but they formed in glacial till and Sylvan soils formed in loess. Hickory soils have natural drainage similar to that of Hennepin soils, which formed in glacial till on another landscape, but Hickory soils have more clay in the B horizon and are deeper to calcareous till.

Hickory and Sylvan soils, 15 to 50 percent slopes, eroded (963F2).—In most areas these soils have short steep slopes and occupy uplands that face bottom lands. The soils occur together without regularity in pattern and proportion, and there are areas of each soil large enough to be mapped separately if it were practical. Individual areas consist entirely of Hickory soils, entirely of Sylvan soils, or some of both.

Included in mapping are small areas of reddish-brown soils and small areas of very old soils covered by 20 to 40 inches of loess.

These Hickory and Sylvan soils are used for pasture and woodland, uses to which they are suited. Erosion is a hazard. Steep slopes restrict the use of some pasture management practices. Most of the woodland on the steeper slopes is of low quality. Management group VIIe–1.

Huntsville Series

The Huntsville series consists of well drained and moderately well drained, nearly level soils on bottom lands. These soils formed in silty water-laid sediments. The native vegetation was probably a mixture of prairie grasses and hardwood trees. The total acreage of these soils is small.

In a representative profile, the surface layer is very dark brown silt loam about 36 inches thick. The underlying layer, to a depth of 60 inches, is dark-brown silt loam.

Huntsville soils are high in organic-matter content and natural fertility. They have moderate permeability and a very high available water capacity.

Most areas of Huntsville soils are cultivated and are well suited to corn, soybeans, oats, wheat, grasses, and legumes. Some small areas that are cut by stream overflow channels remain in pasture or are idle.

Representative profile of Huntsville silt loam, in a cultivated field about 3 miles north of Chestnut, about 1,320 feet in a southwesterly direction along creek from center of road, and 66 feet north from creek bank in the NE¼ sec. 14, T. 19 N., R. 1 W.:

Ap—0 to 9 inches, very dark brown (10YR 2/2) silt loam; very weak, fine, granular structure; friable; neutral; abrupt, smooth boundary.

A1—9 to 36 inches, very dark brown (10YR 2/2) silt loam; very weak, coarse, subangular blocky structure, breaking to weak, medium, granular structure; friable; neutral; diffuse, smooth boundary.

C1—36 to 54 inches, dark-brown (10YR 3/3) silt loam; very weak, coarse, subangular blocky structure, breaking to weak, medium, granular structure; friable; neutral; diffuse, smooth boundary.

C2—54 to 60 inches, dark-brown (10YR 3/3) loam; massive; friable; neutral.

Color of the Ap and A1 horizons is black (10YR 2/1) to very dark grayish brown (10YR 3/2). Combined thickness of these horizons ranges from 25 to 40 inches. Reaction is neutral to mildly alkaline.

Huntsville soils are on bottom lands with Ross and Lawson soils. They are similar to Ross soils but contain more silt and less sand. Huntsville soils have better natural drainage than the darker colored Lawson soils.

Huntsville silt loam (77).—This is the only Huntsville soil mapped in the county. Slope ranges from 0 to 2 percent, though in some places the soil is cut by overflow channels that have slopes greater than 2 percent.

Included in mapping are small areas of Lawson and Ross soils.

This soil is well suited to crops commonly grown in the county if it is protected from overflow and is otherwise well managed. Overflow is a hazard, but it is present only for a short time. Water is retained for longer periods in some of the overflow channels. Generally, this soil does not require artificial drainage. Areas that are inaccessible to farming equipment because of stream meanders are suited to permanent pasture or wildlife habitat. Management group I–3.

Ipava Series

The Ipava series consists of somewhat poorly drained, nearly level soils on uplands. These soils formed in loess more than 60 inches thick under mixed prairie grasses.

In a representative profile, the surface layer is black and very dark brown silt loam about 16 inches thick. The subsoil is silty clay loam about 26 inches thick. The upper 11 inches of this is dark brown mottled with yellowish brown and light gray. The lower 15 inches is mixed yellowish brown and light gray. The underlying material, to a depth of 60 inches, is mixed brownish-gray and yellowish-brown silt loam.

Ipava soils are high in organic-matter content and natural fertility. They have moderate to moderately slow permeability and very high available water capacity.

Most areas of Ipava soils are cultivated. These soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Ipava silt loam, in a cultivated field about 2.5 miles west of Broadwell, 144 feet east and 135 feet south of the NW. corner of NW¼NE¼ sec. 36, T. 19 N., R. 4 W.:

Ap—0 to 7 inches, black (10YR 2/1) silt loam; moderate, fine, granular structure; friable; neutral; abrupt, smooth boundary.

A1—7 to 12 inches, black (10YR 2/1) silt loam; moderate, medium, granular structure; friable; slightly acid; clear, smooth boundary.

A3—12 to 16 inches, very dark brown (10YR 2/2) heavy silt loam; dark-brown (10YR 4/3) splotches; moderate, very fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21t—16 to 21 inches, dark-brown (10YR 4/3) heavy silty clay loam; thin, continuous, very dark grayish-brown (10YR 3/2) coatings; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; few black (10YR 2/1) iron and manganese concretions; moderate, fine, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B22t—21 to 27 inches, dark-brown (10YR 4/3) heavy silty clay loam; thin, continuous, dark grayish-brown (10YR 4/2) clay films; few very dark grayish-brown (10YR 3/2) coatings; common, fine, distinct, yellowish-brown (10YR 5/6) mottles and light-gray (10YR 7/1) mottles; few black (10YR 2/1) iron and manganese concretions; weak and moderate, prismatic structure, breaking to moderate, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B23t—27 to 32 inches, mixed yellowish-brown (10YR 5/6) and light-gray (10YR 7/1) silty clay loam; thin, continuous, dark grayish-brown (10YR 4/2) clay films; some very dark grayish-brown (10YR 3/2) and very dark gray (10YR 3/1) coatings; few black (10YR 2/1) iron and manganese concretions; moderate, medium, prismatic structure, breaking to moderate, coarse, subangular blocky structure; firm; slightly acid; clear, smooth boundary.

B3—32 to 42 inches, mixed yellowish-brown (10YR 5/6) and light-gray (10YR 7/1) light silty clay loam; patchy, very dark grayish-brown (10YR 3/2) and very dark gray (10YR 3/1) coatings; weak, coarse, prismatic structure; friable; neutral; clear, smooth boundary.

C—42 to 60 inches, mixed light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) silt loam; massive; friable; calcareous.

Color of the Ap, A1, and A3 horizons is black (10YR 2/1) to very dark brown (10YR 2/2). Texture is typically silt loam, but in some places it ranges to light silty clay loam. Thickness of the A horizon ranges from 12 to 19 inches. Texture of the B2 horizon is centered on heavy silty clay loam, but it ranges from light silty clay loam to light silty clay.

Ipava soils are mainly on a landscape with Sable and Tama soils. Ipava soils contain more silt in the surface layer and are better drained than Sable soils. Ipava soils have a darker colored surface layer and poorer natural drainage than Tama soils.

Ipava silt loam (43).—This is the only Ipava soil mapped in the county. It typically occurs in irregularly shaped, nearly level areas. In places, however, it occupies slopes at the upper ends of drainageways. Slope ranges from 0 to 3 percent.

Included in mapping are small areas of Sable, Tama, and Lawndale soils. Wet areas less than one acre in size are shown by a conventional symbol on the soil map.

This soil is well suited to the crops commonly grown in the county. Ipava silt loam has few limitations and can be used intensively for crops. Tile drains or shallow surface ditches can be used to improve drainage where needed. There is a slight hazard of erosion in places. Simple erosion control practices reduce soil and water losses. Management group I–4.

Keomah Series

The Keomah series consists of somewhat poorly drained, nearly level soils. These soils are mainly on uplands, but some areas are on stream terraces. Keomah soils formed in loess more than 60 inches thick under mixed hardwood trees.

In a representative profile, the surface layer is dark grayish-brown silt loam about 8 inches thick. The subsurface layer is grayish-brown silt loam about 4 inches thick. The subsoil is silty clay loam and silt loam about 32 inches thick. The upper 16 inches is dark brown, and the lower 16 inches is mixed yellowish brown and pale brown. The underlying material, to a depth of 60 inches, is brownish-gray and yellowish-brown silt loam.

Keomah soils are low in organic-matter content and moderate in natural fertility. They have moderately slow permeability and high or very high available water capacity. Unless previously treated, these soils need lime.

Most areas of Keomah soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Keomah silt loam, in a cultivated field about 4 miles southwest of Mt. Pulaski, 62 feet east and 50 feet north of the SW. corner of SE¼SW¼ sec. 4, T. 17 N., R. 2 W.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, very fine, granular structure; friable; neutral; abrupt, smooth boundary.

A2—8 to 12 inches, grayish-brown (10YR 5/2) silt loam; abundant light-gray (10YR 7/1 when dry) silt grains; many black (10YR 2/1) iron and manganese concretions; moderate, thin, platy structure; friable; medium acid; clear, smooth boundary.

B1t—12 to 16 inches, dark-brown (10YR 4/3) light silty clay loam; thin, continuous, dark grayish-brown (10YR 4/2) clay films; abundant light-gray (10YR 7/1 when dry) silt grains; many black (10YR 2/1) iron and manganese concretions; moderate, very fine and fine, subangular blocky structure; firm; very strongly acid; clear, smooth boundary.

B21t—16 to 22 inches, dark-brown (10YR 4/3) heavy silty clay loam; thin, continuous, dark grayish-brown (10YR 4/2) clay films; many black (10YR 2/1) iron and manganese concretions; moderate, medium, subangular blocky structure; firm; strongly acid; clear, smooth boundary.

B22t—22 to 28 inches, dark-brown (10YR 4/3) heavy silty clay loam; thin, continuous, dark grayish-brown (10YR 4/2) clay films; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; many black (10YR 2/1) iron and manganese concretions; moderate, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B23t—28 to 36 inches, mixed yellowish-brown (10YR 5/6) and pale-brown (10YR 6/3) silty clay loam; thin, discontinuous, very dark gray and dark grayish-brown (10YR 3/1 and 4/2) clay films; few, fine, distinct, yellowish-brown (10YR 5/8) mottles; many black (10YR 2/1) iron and manganese concretions; moderate coarse, subangular blocky structure; firm; neutral; clear, smooth boundary.

B3—36 to 44 inches, mixed yellowish-brown (10YR 5/6) and pale-brown (10YR 6/3) heavy silt loam; thin, patchy, very dark gray (10YR 3/1) clay flows; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; many black (10YR 2/1) iron and manganese concretions; weak, coarse, prismatic structure; friable; neutral; clear, smooth boundary.

C—44 to 60 inches, mixed light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) silt loam; massive; friable; calcareous.

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Color of the Ap horizon is dark gray (10YR 4/1) to dark grayish brown (10YR 4/2), and thickness ranges from 6 to 8 inches. Color of the A2 horizon is from grayish brown (10YR 5/2) to gray (10YR 5/1), and thickness ranges from 3 to 10 inches. Texture of the B2 horizon is centered on heavy silty clay loam, but it ranges from light silty clay loam to light silty clay.

Keomah soils are in patterns with Rushville, Clinton, and Clarksdale soils. Keomah soils have poorer natural drainage than Clinton soils. They are similar to Rushville soils but have better natural drainage. Keomah soils are similar in natural drainage to the Clarksdale soils, but they have a lighter colored surface layer.

Keomah silt loam (17).—This is the only Keomah soil mapped in the county. It occupies broad, nearly level areas. Slope ranges from 0 to 3 percent.

Included in mapping are small areas of Rushville, Clinton, and Clarksdale soils. Wet areas less than one acre in size are shown on the soil map by a conventional symbol.

This soil is suited to crops commonly grown in the county and can be used intensively for cropping. Wetness, low fertility, and poor tilth are limitations. The soil is wet in many places, but tile drains and shallow surface ditches can be used to improve drainage. Crusts form easily on the surface. Additions of organic matter help to improve tilth and increase fertility. There is a slight hazard of erosion in a few places, but simple erosion control practices reduce soil losses. Management group IIw-4.

Knight Series

The Knight series consists of poorly drained, nearly level soils in depressions. These soils are mainly on a stream terrace west of Lincoln where Kickapoo Creek joins Salt Creek and on another stream terrace along Salt Creek north of Middletown. These soils formed under mixed prairie grasses in loess or silty water-laid material 40 to 60 inches thick and the underlying stratified loamy outwash.

In a representative profile, the surface layer is very dark brown silt loam about 16 inches thick. The subsurface layer is grayish-brown silt loam about 11 inches thick. The subsoil is about 20 inches thick. In sequence from the top, the upper 9 inches of the subsoil is grayish-brown silty clay loam, the next 6 inches is yellowish-brown silty clay loam, and the lower 5 inches is yellowish-brown clay loam. The underlying material, to a depth of 60 inches, is gray gravelly clay loam and clay loam.

Knight soils are high in organic-matter content and moderate in natural fertility. They have moderately slow permeability and high available water capacity.

Most areas of Knight soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Knight silt loam, in a cultivated field about 2.5 miles north of Middletown, 528 feet north and 165 feet east of the SW. corner of NW¼ sec. 31, T. 20 N., R. 4 W.:

Ap—0 to 8 inches, very dark brown (10YR 2/2) silt loam; moderate, fine, granular structure and weak, very fine, subangular blocky structure; friable; medium acid; abrupt, smooth boundary.

A1—8 to 16 inches, very dark brown (10YR 2/2) silt loam; moderate, fine, granular structure; friable; medium acid; clear, smooth boundary.

A21—16 to 20 inches, dark grayish-brown (10YR 4/2) silt loam; many very dark grayish-brown (10YR 3/2) coatings; moderate, medium, granular structure; friable; medium acid; clear, smooth boundary.

A22—20 to 27 inches, grayish-brown (10YR 5/2) silt loam; some very dark grayish-brown (10YR 3/2) splotches; many light-gray (10YR 7/1 when dry) silt grains; many black (10YR 2/1)) iron and manganese concretions; weak, medium, platy structure, breaking to moderate, medium, granular structure; friable; medium acid; clear, smooth boundary.

B&A—27 to 30 inches, grayish-brown (10YR 5/2) silt loam or light silty clay loam; some very dark grayish-brown (10YR 3/2) splotches; few black (10YR 2/1) iron and manganese concretions and many light-gray (10YR 7/7 when dry) silt grains; areas of weak, fine, subangular blocky structure and moderate, medium, granular structure; friable; medium acid; clear, irregular boundary.

B21tg—30 to 36 inches, grayish-brown (10YR 5/2) silty clay loam; thin, continuous, gray (10YR 5/1) clay films; many light-gray (10YR 7/1 when dry) silt grains on faces of peds; some black (10YR 2/1) iron and manganese concretions; weak, medium, prismatic structure, breaking to moderate, fine, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B22tg—36 to 42 inches, yellowish-brown (10YR 5/6) silty clay loam; thin, discontinuous, gray (10YR 5/1) clay films; some black (10YR 2/1) iron and manganese concretions; moderate, coarse, prismatic structure, breaking to moderate, medium and coarse, subangular blocky structure; firm; medium acid; clear, smooth boundary.

IIB3g—42 to 47 inches, yellowish-brown (10YR 5/6) clay loam; thin, discontinuous, gray (10YR 5/1) clay films on vertical faces of peds; moderate, coarse, prismatic structure; firm; medium acid; clear, smooth boundary.

IIC1g—47 to 49 inches, gray (10YR 5/1) gravelly clay loam; massive; friable; medium acid; abrupt, smooth boundary.

IIC2g—49 to 52 inches, gray (10YR 5/1) clay loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; friable; medium acid; abrupt, smooth boundary.

IIC3g—52 to 60 inches, dark-gray (10YR 4/1) gravelly clay loam; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; friable; medium acid.

Color of the Ap and A1 horizons is very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2), and thickness ranges from 14 to 20 inches. Color of the A2 horizon is gray (10YR 5/1) to dark grayish brown (10YR 4/2), and thickness ranges from 10 to 17 inches. Combined thickness of the Ap, A1, and A2 horizons ranges from 24 to 37 inches. Texture of the B2 horizon is light silty clay loam to silty clay loam. Texture of the B3 horizon ranges from clay loam to sandy loam.

Knight soils are in patterns with Brenton, Proctor, and Plano soils and have poorer natural drainage than those soils Knight soils also have a distinctive grayish-brown subsurface layer, but Brenton, Proctor, and Plano soils do not.

Knight silt loam (191).—This is the only Knight soil mapped in the county. It occupies some of the long, narrow depressions in channels on stream terraces and also is in small isolated depressions. Slope is less than 2 percent.

Included in mapping are small areas of similar soils with coarser textures in the upper part of the subsoil. Also included are small areas of soils in which the surface and subsurface layers have a combined thickness of less than 24 inches, and a few areas of soils that are somewhat poorly drained.

If this soil is adequately drained, it is suited to crops commonly grown in the county. Wetness is a limitation. Runoff is slow or ponded, and outlets for natural drainage are not adequate. Tile drains do not function well, because of the moderately slow permeability. Tile inlets or shallow surface ditches help to reduce wetness. Management group IIw-3.

Lamont Series

The Lamont series consists of well drained, gently sloping to steep soils. These soils are mainly on uplands in Corwin Township, but a few areas are on stream terraces. Lamont soils formed in more than 60 inches of wind-deposited sand. The native vegetation was hardwood trees.

In a representative profile, the surface layer is dark grayish-brown sandy loam about 4 inches thick. The subsurface layer is brown sandy loam about 4 inches thick. The subsoil is strong-brown sandy loam about 18 inches thick. The underlying material is strong-brown, loose sand.

Lamont soils are low in organic-matter content and natural fertility. They have moderately rapid to rapid permeability and low available water capacity. Unless previously treated, these soils need lime.

A considerable acreage of Lamont soils is cultivated, but a small acreage is in pasture or woodland.

In Logan County, Lamont soils are so closely intermingled with Alvin soils that they were mapped only in complexes with those soils. The complexes are described under the Alvin series.

Representative profile of Lamont sandy loam, from an area of Alvin-Lamont sandy loams, 12 to 30 percent slopes, in a pasture about 2 miles east of Middletown, 660 feet east and 495 feet north of the SW. corner of SE¼ SW¼ sec. 16, T. 19 N., R. 4 W.:

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, very fine, granular strutcure; friable; medium acid; clear, smooth boundary.

A2—4 to 8 inches, brown (10YR 5/3) light sandy loam; many dark grayish-brown (10YR 4/2) coatings; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, very fine and fine, granular structure; friable; medium acid; clear, wavy boundary.

B1—8 to 15 inches, strong-brown (7.5YR 5/6) sandy loam; patchy areas of dark brown (7.5YR 4/4); weak, fine, subangular blocky structure; friable; medium acid; clear, wavy boundary.

B2—15 to 26 inches, strong-brown (7.5YR 5/6) sandy loam; patchy areas of dark brown (7.5YR 4/4); few black (5YR 2/1) iron and manganese concretions; weak, medium and coarse, subangular blocky structure; friable; medium acid; clear, wavy boundary.

C1—26 to 33 inches, strong-brown (7.5YR 5/6) sand; single grain; loose; medium acid; clear, wavy boundary.

C2—33 to 60 inches, dark-brown (7.5YR 4/4) sand; loamy sand or light sandy loam bands about ½ inch thick and spaced about 3 inches apart; single grain; loose; medium acid. Bands are massive, friable, and medium acid.

Color of the A1 horizon ranges from dark grayish brown (10YR 4/2) to dark brown (10YR 3/3), and thickness ranges from 3 to 8 inches. The A2 horizon has been mixed with the A1 horizon in most cultivated areas. Where the A2 horizon is present, it ranges from 3 to 10 inches in thickness. Color of the A2 horizon is from brown (10YR 5/3) to yellowish brown (10YR 5/4). Thickness of the B horizon ranges from 8 to 20 inches, and texture is sandy loam to loamy sand.

Lamont soils are next to Alvin soils. Thebes and Middletown soils are nearby. Lamont soils contain more sand in the subsoil than Alvin soils. They have more sand in the surface layer and upper part of the subsoil than Thebes and Middletown soils.

Lawndale Series

The Lawndale series consists of somewhat poorly drained, nearly level soils. These soils are common on the uplands in the northwestern part of the county. They formed under mixed prairie grasses in 40 to 50 inches of loess and the underlying sand.

In a representative profile, the surface layer is silt loam about 18 inches thick. The upper 13 inches is black, and the lower 5 inches is very dark brown. The subsoil is about 34 inches thick. In sequence from the top, the upper 13 inches of the subsoil is dark grayish-brown and dark-brown silty clay loam. The next 7 inches is yellowish-brown heavy silt loam, and the lower 8 inches is dark yellowish-brown loamy sand. The underlying material, to a depth of 60 inches, is yellowish-brown fine sand.

Lawndale soils are high in organic-matter content and natural fertility. They have moderate permeability and very high available water capacity.

Most areas of these soils are cultivated. Lawndale soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Lawndale silt loam, in a cultivated field about 3.5 miles southwest of Emden, 525 feet east and 665 feet south of the NW. corner of NW¼NE¼ sec. 21, T. 21 N., R. 4 W.:

Ap—0 to 6 inches, black (10YR 2/1) silt loam, very dark brown (10YR 2/2) when crushed, dark gray (10YR 4/1) when dry; moderate, very fine, granular structure; friable; medium acid; abrupt, smooth boundary.

A1—6 to 13 inches, black (10YR 2/1) silt loam, dark gray (10YR 4/1) when dry; moderate, medium, granular structure; friable; medium acid; clear, smooth boundary.

A3—13 to 18 inches, very dark brown (10YR 2/2) heavy silt loam, very dark grayish brown (10YR 2/2) when crushed, dark gray (10YR 4/1) when dry; moderate, coarse, granular structure; friable; medium acid; clear, smooth boundary.

B21t—18 to 23 inches, dark grayish-brown (10YR 4/2) silty clay loam, dark grayish brown (10YR 4/2) when crushed; thin, continuous, dark grayish-brown (10YR 4/2) clay films; some very dark brown (10YR 2/2) coatings; moderate, very fine, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B22t—23 to 31 inches, dark-brown (10YR 4/3) silty clay loam, olive brown (2.5Y 4/4) when crushed; thin, continuous, dark grayish-brown (10YR 4/2) clay films; common, fine, distinct, light brownish-gray (10YR 6/2) mottles and common, fine distinct, yellowish-brown (10YR 5/8) mottles; few, fine, black (5YR 2/1) iron and manganese concretions; moderate, fine, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B23t—31 to 38 inches, yellowish-brown (10YR 5/6) silty clay loam, olive brown (2.5Y 4/4) when crushed; thin, discontinuous, dark grayish-brown (10YR 4/2) clay films; few, fine, faint, yellowish-brown (10YR 5/8) mottles and few, fine, distinct, light brownish-gray (10YR 6/2) mottles; few, fine, black (5YR 2/1) iron and manganese concretions; moderate, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B31—38 to 44 inches, yellowish-brown (10YR 5/6) heavy silt loam, light olive brown (2.5Y 5/4) when crushed; thin, patchy, dark grayish-brown (10YR 4/2) clay films; few, fine, faint, yellowish-brown (10YR 5/8) mottles; moderate, coarse, subangular blocky structure; friable; slightly acid; abrupt, smooth boundary.

11B32—44 to 52 inches, dark yellowish-brown (10YR 3/4) loamy sand, dark yellowish brown (10YR 4/4) when crushed; some areas of dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4); weak, coarse, subangular blocky structure; friable; slightly acid; gradual, smooth boundary.

11C—52 to 60 inches, yellowish-brown (10YR 5/8) fine sand; single grain; loose; slightly acid.

Color of the Ap and A1 horizons is black (10YR 2/1) to very dark brown (10YR 2/2). Color of the A3 horizon is very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2), and texture ranges from heavy silt loam to light silty clay loam. Combined thickness of the Ap, A1, and A3 horizons ranges from 12 to 20 inches. Depth to sand ranges from 40 to 58 inches. About 5 to 15 inches of the subsoil formed in the underlying sand.

Lawndale soils are in patterns with Broadwell, Sable, and Brooklyn soils. They have a darker colored surface layer and poorer natural drainage than Broadwell soils. Lawndale soils contain more silt in the surface layer and have better natural drainage than Sable soils. They are better drained than Brooklyn soils and do not have a gray subsurface layer.

Lawndale silt loam (683).—This is the only Lawndale soil mapped in the county. It occupies small and large, nearly level areas among areas of more sloping soils. In some places it is surrounded by poorly drained soils in depressions. Slope ranges from 0 to 3 percent.

Included in mapping are small areas of Sable soils. Sandy and wet areas less than one acre in size are shown on the soil map by conventional symbols.

This soil is well suited to the crops commonly grown in the county. It has few limitations and is well suited to intensive cropping. Tile drains or shallow surface ditches can be used to improve drainage where needed. In places the soil is subject to erosion, but simple erosion control practices reduce soil losses. Management group 1–4.

Lawson Series

The Lawson series consists of somewhat poorly drained, nearly level soils on bottom lands. These soils formed in silty water-laid sediments. The native vegetation was probably a mixture of prairie grasses and hardwood trees.

In a representative profile, the surface layer is black and very dark gray silt loam about 37 inches thick. Underlying the surface layer, to a depth of about 53 inches, is dark grayish-brown loam. Below this, to a depth of about 60 inches, is dark grayish-brown, dark-brown, and brown loamy sand or sand.

Lawson soils are high in organic-matter content and natural fertility. They have moderate permeability and very high available water capacity.

Most areas of Lawson soils are cultivated. These soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes. Some areas cut up by stream overflow channels are in pasture.

Representative profile of Lawson silt loam, in a pasture about 3 miles southwest of Hartsburg, about 330 feet south along road from south edge of bridge over Sugar Creek and 80 feet west from road, in the NE¼NE¼ sec. 7, T. 20 N., R. 3 W.:

A11—0 to 13 inches, black (10YR 2/1) silt loam; moderate, very fine, granular structure; friable; neutral; gradual, smooth boundary.

A12—13 to 33 inches, very dark gray (10YR 3/1) silt loam; weak, very fine, granular structure; friable; neutral; gradual, smooth boundary.

A13—33 to 37 inches, very dark gray (10YR 3/1) silt loam; weak, medium, granular structure; friable; neutral; clear, smooth boundary.

C1—37 to 53 inches, dark grayish-brown (10YR 4/2) loam; common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, coarse, granular structure; friable; neutral; abrupt, smooth boundary.

IIC2—53 to 60 inches, mixed dark grayish-brown (10YR 4/2) and dark-brown or brown (7.5YR 4/4) loamy sand or sand; single grain; loose; neutral.

Color of the A1 horizon is black (10YR 2/1) to very dark gray (10YR 3/1), and thickness ranges from 24 to 40 inches. Reaction is from slightly acid to mildly alkaline. Texture below a depth of 40 inches ranges from silt loam to sand.

Lawson soils are on bottom lands next to Radford and Sawmill soils. They are similar in natural drainage to Radford soils, but lack the buried, dark-colored silty clay loam soil within a depth of 40 inches. They have better natural drainage than Sawmill soils and do not contain as much clay.

Lawson silt loam (451).—This is the only Lawson soil mapped in the county. It occupies areas next to stream channels or against upland slopes where small drainageways from the upland enter the bottom land. Lawson silt loam is nearly level; slope ranges from 0 to 2 percent. In some places the soil is cut by overflow channels that have a slope of more than 2 percent.

Included in mapping are small areas of Radford and Sawmill soils and of similar soils that have a loam surface layer. Also included is a small acreage of soils that are shallow over sand. Sandy areas less than one acre in size are shown on the soil map by a conventional symbol.

This soil is suited to the crops commonly grown in the county and can be intensively cropped. Overflow is a hazard, runoff is slow, and many places are wet. In places this soil also receives runoff from nearby uplands. Adequate tile outlets and open ditches are difficult to maintain in places because of overflow. Management group 1–5.

Miami Series

The Miami series consists of well-drained, strongly sloping to very steep soils. These soils are on uplands in the northeastern part of the county. They are mainly in Eminence and Atlanta Townships. They formed in glacial till under mixed hardwood trees.

In a representative profile, the surface layer is dark-brown silt loam about 8 inches thick. The subsoil is dark yellowish-brown clay loam about 31 inches thick. The underlying material, to a depth of about 60 inches, is light olive-brown loam.

Miami soils are low in organic-matter content and moderate in natural fertility. They have moderate permeability and high available water capacity. Unless previously treated, these soils need lime.

Some areas of Miami soils are cultivated, and some are in pasture or woodland that is grazed. In some places these soils are suited to corn, soybeans, oats, wheat, grasses, and legumes, and in other places they are suited to permanent pasture or woodland.

In Logan County, Miami soils were mapped in complexes with Birkbeck and Russell soils and in an undifferentiated group with Hennepin soils.

Representative profile of Miami silt loam from an area of Hennepin and Miami soils, 18 to 60 percent slopes, in a cultivated field about 3.5 miles southeast of Atlanta, 423 feet south and 255 feet east of the NW. corner of sec. 25, T. 21 N., R. 1 W.:

Ap—0 to 8 inches, dark-brown (10YR 4/3) heavy silt loam; moderate, very fine, granular structure; friable; many small till pebbles and stones; slightly acid; abrupt, smooth boundary.

B21t—8 to 14 inches, dark yellowish-brown (10YR 4/4) clay loam; thin, continuous, dark yellowish-brown (10YR 3/4) clay films; moderate, very fine, angular blocky structure; firm; many small till pebbles and stones; strongly acid; clear, smooth boundary.

B22t—14 to 22 inches, dark yellowish-brown (10YR 4/4) clay loam; thin, continuous, dark yellowish-brown (10YR 3/4) clay films; moderate, medium, subangular blocky structure; firm; many small till pebbles and stones; strongly acid; clear, smooth boundary.

B23t—22 to 32 inches, dark yellowish-brown (10YR 4/4) clay loam; thin, dark yellowish-brown (10YR 3/4) clay films mainly on vertical faces of peds; moderate, coarse, subangular blocky structure; firm; many small till pebbles and stones; strongly acid; clear, smooth boundary.

B3—32 to 39 inches, dark yellowish-brown (10YR 4/4) light clay loam; thick, very dark grayish-brown (10YR 3/2) clay coatings or flows on vertical faces of peds; weak, coarse, subangular blocky structure; firm; many small till pebbles and stone; medium acid; clear, irregular boundary.

C—39 to 60 inches, light olive-brown (2.5Y 5/4) loam; massive; friable; calcareous; many small till pebbles and stones.

Color of the Ap horizon is dark grayish brown (10YR 4/2) to dark brown (10YR 4/3). Texture ranges from silt loam to clay loam. Thickness is 3 to 8 inches. Texture of the B21t horizon is clay loam to silty clay loam. Depth to calcareous till ranges from 24 to 42 inches.

Miami soils are on landscapes with Birkbeck, Russell, and Hennepin soils. Miami soils differ from Birkbeck and Russell soils because their subsoil formed almost entirely in till. Miami soils also are better drained than Birkbeck soils. Both Miami and Hennepin soils formed in till, but in Hennepin soils the calcareous till is closer to the surface.

Miami-Russell silt loams, 12 to 18 percent slopes, eroded (966E2).—These soils occupy short side slopes of drainageways. Miami silt loam makes up 60 to 70 percent of the acreage in this mapping unit. The profiles of these soils are similar to those described as representative for their respective series, but in places calcareous till is shallower than the depth described.

Included in mapping are small areas where the surface layer is almost entirely subsoil material.

These soils are suited to small grains, hay, and permanent pasture. Erosion is a severe hazard, and low fertility is a limitation where the soils are cultivated. Management group IVe–1.

Middletown Series

The Middletown series consists of well drained and moderately well drained, nearly level to strongly sloping soils on uplands. The soils are common in Corwin, Mt. Pulaski, and Broadwell Townships. They formed under mixed hardwood trees in loess 40 to 50 inches thick and the underlying sand.

In a representative profile, the surface layer is dark-brown silt loam about 8 inches thick. The subsoil is about 45 inches thick and dark yellowish brown. The uppermost 32 inches is silty clay loam, the next 8 inches is heavy silt loam, and the lower 5 inches is loamy sand. Underlying the subsoil, to a depth of 60 inches, is strong-brown fine sand.

Middletown soils are low in organic-matter content and moderate in natural fertility. They have moderate permeability and high available water capacity. Unless previously treated, these soils need lime.

Almost all areas of Middletown soils are cultivated, but some are in pasture and woodland. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Middletown silt loam, 1 to 4 percent slopes, in a pasture about 3 miles east of Middletown, about 579 feet east from lane opposite old farmhouse site in the SW¼NE¼ sec. 15, T. 19 N., R. 4 W.:

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam, pale brown (10YR 6/3) when dry; weak, fine, granular structure; friable; neutral; abrupt, smooth boundary.

B21t—8 to 12 inches, dark yellowish-brown (10YR 4/4) light silty clay loam, light yellowish brown (10YR 6/4) when dry; many white (10YR 8/2 when dry) silt grains on faces of peds; moderate, very fine, subangular blocky structure; firm; slightly acid; clear, smooth boundary.

B22t—12 to 18 inches, dark yellowish-brown (10YR 4/4) silty clay loam, light yellowish brown (10YR 6/4) when dry; thin, continuous, dark-brown (7.5YR 4/4) clay films; many white (10YR 8/2 when dry) silt grains on faces of peds; moderate, fine, subangular blocky structure; firm; slightly acid; clear, smooth boundary.

B23t—18 to 25 inches, dark yellowish-brown (10YR 4/4) silty clay loam; brown (7.5YR 5/4) when dry; thin, continuous, dark-brown or brown (7.5YR 4/4) clay films; many white (10YR 8/2 when dry) silt grains on faces of peds; moderate, fine and medium, subangular blocky structure; firm; strongly acid; clear, smooth boundary.

B24t—25 to 40 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; thin, continuous, dark-brown (7.5YR 4/4) clay films; few black (5YR 2/1) iron and manganese concretions; many white (10YR 8/2 when dry) silt grains on faces of peds; moderate, medium and coarse, subangular blocky structure; firm; very strongly acid; clear, smooth boundary.

B31—40 to 48 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; thin, discontinuous, dark-brown (7.5YR 4/4) clay films; few black (5YR 2/1) iron and manganese concretions; many white (10YR 8/2 when dry) silt grains on faces of peds; weak, coarse, subangular blocky structure; friable; very strongly acid; abrupt, smooth boundary.

IIB32—48 to 53 inches, dark yellowish-brown (10YR 4/4) loamy sand; weak, coarse, subangular blocky structure; very friable; strongly acid; gradual, smooth boundary.

IIC—53 to 60 inches, strong-brown (7.5YR 5/6) fine sand; single grain; loose; strongly acid.

Color of the Ap horizon is dark grayish brown (10YR 4/2) to dark brown or brown (10YR 4/3). Texture is typically silt loam but ranges to silty clay loam where the soil is eroded. Thickness of the Ap horizon is 4 to 8 inches. Texture of the B21t horizon is centered on light silty clay loam, but ranges from heavy silt loam to silty clay loam. Texture of the B32 horizon ranges from loam to loamy sand. About 5 to 15 inches of the subsoil formed in the underlying sand. Depth to sand ranges from 42 to 58 inches.

Middletown soils are on a landscape with Thebes, Alvin, Lamont, and Clinton soils. Middletown soils have loose sand at a greater depth than Thebes soils. They have less sand in the surface layer and subsoil than Alvin and Lamont soils. The lower part of the subsoil of Middletown soils formed in sand, whereas the entire subsoil of Clinton soils formed in loess.

Middletown silt loam, 1 to 4 percent slopes (685B).—This soil is the most extensive of Middletown soils, and it has the profile described as representative for the series. It occupies irregularly shaped divides between areas of more sloping soils. In places it has gentle slopes and occupies long, narrow ridges. In other places it is nearly level.

Included in mapping are some areas where the subsoil is mottled. Also included are small areas of Thebes soils and Alvin-Lamont sandy loams. Areas less than one acre in size that have a sandy surface layer are shown on the soil map by a conventional symbol.

This soil is suited to crops commonly grown in the county. If properly managed, it can be intensively cropped. Erosion is a hazard, and without erosion control practices, this soil is not suited to intensive cropping. Low fertility and poor tilth are limitations. The surface layer is low in organic-matter content, and crusts form easily. Terracing, contouring, minimum tillage, conservation of residue, and grassed waterways help to control erosion, increase and maintain fertility, and improve tilth. Management group IIe–1.

Middletown silt loam, 4 to 7 percent slopes eroded (685C2)—This soil occupies irregularly shaped divides between areas of more sloping soils, short sides slopes of drainageways, and long, narrow ridges. It has a profile similar to that described as representative, but the subsoil is thinner and in some places is mottled. Plowing has mixed part of the upper subsoil with the remaining part of the original surface layer. Thickness of the present surface layer is about equal to the depth of plowing.

Included in mapping are small areas of Thebes soils and Alvin-Lamont sandy loams. Also included are small areas that have a surface layer consisting almost entirely of dark yellowish-brown subsoil material. Small areas less than one acre in size that have a sandy surface layer are shown on the soil map by a conventional symbol.

This soil is suited to crops commonly grown in the county. Erosion is a hazard, and without erosion control practices, this soil is not suited to intensive cropping. Low fertility and poor tilth are limitations. Erosion control practices reduce soil losses. Additions of organic matter improve tilth and increase fertility. Management group IIe–1.

Middletown silt loam, 7 to 15 percent slopes, eroded (685D2).—This soil occupies short side slopes along drainageways. The combined thickness of the surface layer and subsoil is less than that described as representative for the series. The surface layer consists partly of subsoil material; its thickness is about equal to the depth of plowing. In some small areas the surface layer consists almost entirely of subsoil material.

Included in mapping are small areas of only slightly eroded soils. Also included are small areas of Alvin-Lamont sandy loams and Thebes soils. Sandy areas less than one acre in size are shown on the soil map by a conventional symbol.

This soil is suited to the crops commonly grown in the county, but is not suited to intensive cropping. Erosion is a severe hazard. Fertility is somewhat lower than that described as representative for the series, and tilth is poor. Crusts and clods form easily on the surface. Terracing, contouring, minimum tillage, and conservation of residue will help to control erosion, increase and maintain fertility, and improve tilth. Management group IIIe–1.

Muscatine Series

The Muscatine series consists of somewhat poorly drained, nearly level soils on terraces. These soils formed under mixed prairie grasses in loess or silty water-laid material more than 60 inches thick.

In a representative profile, the surface layer is black heavy silt loam about 20 inches thick. The subsoil is about 26 inches thick. In sequence from the top, the upper 4 inches is dark-brown and grayish-brown heavy silt loam, the next 14 inches is dark-brown and grayish-brown silty clay loam mottled with yellowish brown, and the lower 8 inches is grayish-brown heavy silt loam mottled with strong brown and yellowish brown. The underlying material, to a depth of 63 inches, is mixed gray and strong-brown silt loam.

Muscatine soils are high in organic-matter content and natural fertility. They have moderate permeability and very high available water capacity.

Nearly all areas of Muscatine soils are cultivated. These soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Muscatine silt loam, in a cultivated field about 2 miles north of Burton View, 310 feet west and 330 feet south of the NE. corner of sec. 12, T. 20 N., R. 4 W.:

Ap—0 to 9 inches, black (10YR 2/1) heavy silt loam; moderate, very fine, granular structure; friable; neutral; abrupt, smooth boundary.

A11—9 to 14 inches, very dark brown (10YR 2/2) heavy silt loam; dark grayish-brown (10YR 4/2) splotches; moderate, fine, granular structure; friable; medium acid; clear, smooth boundary.

A12—14 to 20 inches, very dark grayish-brown (10YR 3/2) heavy silt loam; very dark brown (10YR 2/2) splotches; moderate, medium, granular structure; friable; medium acid; clear, smooth boundary.

B1—20 to 24 inches, dark-brown (10YR 4/3) heavy silt loam; thin, continuous, dark grayish-brown (10YR 4/2) clay films; few, fine, faint, yellowish-brown (10YR 5/6) mottles; very dark grayish-brown (10YR 3/2) coatings; weak, very fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21t—24 to 30 inches, dark-brown (10YR 4/3) silty clay loam; thin, continuous, grayish-brown (10YR 5/2) clay films; few, fine, distinct, yellowish-brown (10YR 5/6) and dark-gray (10YR 4/1) organic coatings; moderate, very fine, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B22t—30 to 38 inches, dark-brown (10YR 4/3) silty clay loam; thin, continuous, gray (10YR 5/1) clay films; few, medium, distinct, dark-brown (7.5YR 3/2) coatings; common, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, fine and medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B3—38 to 46 inches, grayish-brown (10YR 5/2) heavy silt loam; thin, discontinuous, gray (10YR 5/1) clay films; common, medium, distinct, strong-brown (7.5YR 5/8) mottles and few, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, prismatic structure, parting to weak, medium and coarse, subangular blocky structure; friable; medium acid; clear, smooth boundary.

C—46 to 63 inches, mixed gray and light-gray (10YR 6/1) and strong-brown (7.5YR 5/8) silt loam; massive; friable; neutral.

Color of the Ap and A1 horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2); thickness ranges from 12 to 22 inches. Texture of the B2 horizon is centered on silty clay loam, but ranges from heavy silt loam to heavy silty clay loam. Depth to the C horizon is 40 to 60 inches.

Muscatine soils are in a soil pattern with Sable, Denny, and Tama soils. Muscatine soils have poorer natural drainage than Tama soils; they have less clay in the surface layer and are better drained than Sable soils; and they have a darker colored surface layer and are better drained than Denny soils.

Muscatine silt loam (41).—This is the only Muscatine soil mapped in the county. It occupies broad, irregularly shaped areas on stream terraces. It is common on terraces along Sugar and Deer Creeks. Slope ranges from 0 to 3 percent. Included in mapping are small areas of Denny and Sable soils.

Muscatine silt loam has few limitations. Tile drains or shallow surface ditches can be used to improve drainage where needed. Under proper management, this soil can be intensively cropped. Management group I–4.

Onarga Series

The Onarga series consists of well drained and moderately well drained, nearly level to strongly sloping soils. Most areas of these soils are on the uplands, but a few are on stream terraces. Onarga soils are common in the northwestern part of the county. They formed under mixed prairie grasses in more than 60 inches of wind-deposited sand.

In a representative profile, the surface layer is very dark brown and very dark grayish-brown sandy loam about 13 inches thick. The subsoil is dark-brown and dark yellowish-brown sandy clay loam and sandy loam about 22 inches thick. Underlying the subsoil, to a depth of about 60 inches, is dark yellowish-brown, loose sand.

Onarga soils are moderate in organic-matter content and natural fertility. They have moderate or moderately rapid permeability and moderate available water capacity.

Nearly all areas of Onarga soils are cultivated. These soils are not as well suited to corn, soybeans, and oats as they are to wheat, grasses, and legumes.

Onarga soils are so closely intermingled with Dickinson soils that they were mapped in complexes with those soils. The complexes are described under the Dickinson series.

Representative profile of Onarga sandy loam from an area of Dickinson-Onarga sandy loams, 2 to 7 percent slopes, in a cultivated field at the east edge of Emden, 240 feet east and 495 feet north of the SW. corner of SE$\frac{1}{4}$ sec. 6, T. 21 N., R. 3 W.:

Ap—0 to 7 inches, very dark brown (10YR 2/2) sandy loam; weak, very fine and fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A1—7 to 13 inches, very dark grayish-brown (10YR 3/2) heavy sandy loam; weak to moderate, fine, granular structure; friable; medium acid; clear, smooth boundary.

B1—13 to 18 inches, dark-brown (10YR 4/3) light sandy clay loam; few very dark grayish-brown (10YR 3/2) organic films in the upper few inches; weak and moderate, fine, subangular blocky structure; friable; medium acid; gradual, smooth boundary.

B2t—18 to 28 inches, dark-brown (10YR 4/3) sandy clay loam; thin, discontinuous, dark-brown (10YR 3/3) clay films; few very dark brown (10YR 2/2) worm casts; weak and moderate, fine and medium, subangular blocky structure; friable; medium acid; gradual, smooth boundary.

B3—28 to 35 inches, dark yellowish-brown (10YR 4/4) light sandy loam; thin, discontinuous, dark-brown (10YR 3/3) clay films; weak, medium, subangular blocky structure; friable; medium acid; clear, wavy boundary.

C—35 to 60 inches, dark yellowish-brown (10YR 4/4) sand; single grain; loose; medium acid.

Color of the Ap and A1 horizons ranges from very dark brown (10YR 2/2) to dark brown (10YR 3/3), and the combined thickness of these horizons ranges from 10 to 17 inches. Texture of the B horizon ranges from clay loam to sandy loam. Depth to loose sand is less than 40 inches.

In mapping units 974C2 and 974D2, the combined thickness of the Ap and A1 of Onarga is thinner than the range defined for the series. This difference does not alter the usefulness or behavior of the soils.

Onarga soils are next to Dickinson soils. Broadwell and Lawndale soils are nearby. Onarga soils have more clay in the B2 horizon than Dickinson soils. They contain more sand in the surface layer and subsoil than Broadwell and Lawndale soils.

Parr Series

The Parr series consists of well-drained, moderately sloping to moderately steep soils. These soils are on uplands in the northeastern part of the county. They formed under mixed prairie grasses in loess less than 18 inches thick and the underlying glacial till.

In a representative profile, the surface layer is very dark brown silt loam about 9 inches thick. The subsoil is dark yellowish-brown clay loam about 22 inches thick. Underlying the subsoil, to a depth of 60 inches, is yellowish-brown loam.

Parr soils are moderate in organic-matter content and natural fertility. They have moderate permeability and high available water capacity.

Most areas of Parr soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Parr silt loam, 7 to 18 percent slopes, eroded, in a cultivated field about 3 miles east of Atlanta, 435 feet east and 87 feet south of the NW. corner of sec. 24, T. 21 N., R. 1 W.:

Ap—0 to 9 inches, very dark brown (10YR 2/2) silt loam; moderate, fine, granular structure; friable; grit and small pebbles in horizon; medium acid; clear, smooth boundary.

B1—9 to 15 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; splotches of very dark brown (10YR 2/2) organic coatings; moderate, very fine, subangular blocky structure; friable; grit and small till pebbles; medium acid; clear, smooth boundary.

IIB21t—15 to 21 inches, dark yellowish-brown (10YR 4/4) clay loam; thin, continuous, dark brown (10YR 3/4) clay films; moderate, very fine and fine, subangular blocky structure; firm; many small till pebbles; medium acid; clear, smooth boundary.

IIB22t—21 to 27 inches, dark yellowish-brown (10YR 4/4) clay loam; thin, discontinuous, dark yellowish-brown (10YR 3/4) clay films; moderate, medium, subangular blocky structure; firm; many small till pebbles; slightly acid; clear, smooth boundary.

IIB3—27 to 31 inches, dark yellowish-brown (10YR 4/4) light clay loam; patchy, dark yellowish-brown (10YR 3/4) clay films on vertical faces of peds; moderate, medium and coarse, subangular blocky structure; firm; many small till pebbles; neutral; clear, smooth boundary.

IIC—31 to 60 inches, yellowish-brown (10YR 5/4) loam till; massive; friable; many small till pebbles; calcareous.

Color of Ap horizon ranges from very dark brown (10YR 2/2) to brown (10YR 3/3). Texture ranges from silt loam to clay loam, and thickness is 6 to 10 inches. Texture of the B1 horizon is light silty clay loam to clay loam. Total thickness of the B horizon ranges from 20 to 30 inches. Thickness of loess is less than 18 inches. Depth to calcareous till ranges from 24 to 40 inches.

All the Parr soils in Logan County have a dark-colored A horizon that is thinner than the range defined for the series. This difference does not alter the usefulness or behavior of the soils.

Parr soils are on a landscape with Catlin and Tama soils. They differ from Catlin and Tama soils because almost all of their subsoil formed in loam till.

Parr silt loam, 4 to 7 percent slopes, eroded (221C2).—This soil occupies both long and short side slopes of drainageways. The profile of this soil is similar to the one described as representative for the series except that the subsoil is thicker. The present surface layer is a mixture of the original surface layer and part of the upper subsoil. Thickness of this layer is about equal to plow depth. Till pebbles and a few stones are on the surface.

Included in mapping are small areas where the surface layer consists almost entirely of dark yellowish-brown subsoil material.

This soil is suited to crops commonly grown in the county. Erosion is a hazard, and poor tilth is a limitation. If the soil is cropped intensively, erosion control measures are needed to reduce soil losses. Additions of organic matter help to improve tilth. Management group IIe–2.

Parr silt loam, 7 to 18 percent slopes, eroded (221D2).—This soil has the profile described as representative for the series. It occupies short side slopes of drainageways. Plowing has mixed subsoil material with the remaining part of the original surface layer. Till pebbles and small stones are on the surface.

Included in mapping are small areas where the surface layer consists almost entirely of dark yellowish-brown subsoil material.

This soil is suited to crops commonly grown in the county, but is not suited to intensive cropping. The steeper slopes are suited to small grains and legumes. Erosion is a severe hazard, and tilth is poor. Erosion control measures and additions of organic matter help to reduce soil losses and improve tilth. Management group IIIe–2.

Pillot Series

The Pillot series consists of well-drained, gently sloping to moderately sloping soils. These soils are mainly on uplands in Prairie Creek Township; a few areas are on stream terraces. They formed under mixed prairie grasses in loess less than 40 inches thick and in the underlying deposited sand.

In a representative profile, the surface layer is very dark brown silt loam about 15 inches thick. The upper 11 inches is very dark brown, and the lower 4 inches is very dark grayish-brown. The subsoil is dark yellowish-brown and about 21 inches thick. The upper 17 inches of the subsoil is silty clay loam, and the lower 4 inches is sandy clay loam and sandy loam. Underlying the subsoil, to a depth of 60 inches, is yellowish-brown sand.

Pillot soils are high in organic-matter content and in natural fertility. They have moderate permeability and moderate available water capacity.

Most areas of Pillot soils are cultivated. Generally, these soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Pillot silt loam, 1 to 4 percent slopes, in a cultivated field about 2 miles south of San Jose, 255 feet west and 30 feet north of the SE. corner of the SW¼ sec. 7, T. 21 N., R. 4 W.:

Ap—0 to 8 inches, very dark brown (10YR 2/2) silt loam; moderate, fine and medium, granular structure; friable; medium acid; abrupt, smooth boundary.

A1—8 to 11 inches, very dark brown (10YR 2/2) silt loam; moderate, fine and medium, granular structure; friable; medium acid; clear, smooth boundary.

A3—11 to 15 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and medium, granular structure; friable; medium acid; clear, smooth boundary.

B1—15 to 19 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; many dark-brown (10YR 3/3) organic coatings; moderate, very fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21t—19 to 24 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, continuous, dark-brown to brown (10YR 4/3) clay films; moderate, very fine and fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B22t—24 to 32 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, discontinuous, dark-brown (10YR 3/3) clay films; moderate, fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

IIB3—32 to 36 inches, dark yellowish-brown (10YR 3/4) sandy clay loam in the upper half and sandy loam in the lower half; weak, fine, subangular blocky structure; friable; medium acid; abrupt, smooth boundary.

IIC1—36 to 41 inches, yellowish-brown (10YR 5/6) loamy sand or sand; some dark yellowish-brown (10YR 4/4) patches; single grain; loose; medium acid; abrupt, smooth boundary.

IIC2—41 to 43 inches, dark yellowish-brown (10YR 3/4) light sandy loam or loamy sand; single grain; loose; medium acid; abrupt, smooth boundary.

IIC3—43 to 60 inches, yellowish-brown (10YR 5/6) loamy sand or sand; a few thin bands of light sandy loam; single grain; loose; medium acid.

Color of the Ap, A1, and A3 horizons ranges from very dark brown (10YR 2/2) to dark brown (10YR 3/3), and the combined thickness ranges from 10 to 19 inches.

In mapping unit 159C2, the combined thickness of the Ap, A1, and A3 horizons is less than the range defined for the series. This difference does not alter the usefulness or behavior of this soil.

Pillot soils are in patterns with Broadwell, Dickinson, and Onarga soils. Pillot soils differ from Broadwell soils in having loose sand at a depth of less than 40 inches. Pillot soils have less sand in the surface layer and upper part of the subsoil than Dickinson and Onarga soils.

Pillot silt loam, 1 to 4 percent slopes (159B).—This soil has the profile described as representative for the series. It lies along drainageways or on small rises surrounded by other nearly level soils.

Included in mapping are small areas of Broadwell soils and small eroded areas. In the eroded inclusions the soil is not so dark colored as the Pillot soil and has a thinner surface layer. Sandy areas less than one acre in size are shown by a conventional symbol on the soil map.

This soil is suited to intensive cropping. Erosion is a hazard, and droughtiness is a limitation. Because many areas of this soil are small, they are farmed in the same manner as surrounding soils. Erosion control practices are needed to reduce soil losses. Management group IIe–2.

Pillot silt loam, 4 to 10 percent slopes, eroded (159C2).—This is the most extensive of the Pillot soils. It occupies short side slopes of drainageways. The surface layer and subsoil are thinner than those described as representative for the series. Thickness of the surface layer is about equal to the depth of plowing. Plowing mixes subsoil material with the original surface layer.

Included in mapping are small areas where the surface layer consists almost entirely of dark yellowish-brown subsoil material. Sandy areas less than one acre in size are shown by a conventional symbol on the soil map.

This soil is suited to crops commonly grown in the county, but is not suited to intensive cultivation. Erosion is a hazard, and droughtiness is a limitation. Erosion control practices are needed to reduce soil and water losses. Management group IIIe–3.

Plano Series

The Plano series consists of well drained and moderately well drained, nearly level to moderately sloping soils. These soils are commonly on stream terraces, but they are also on the uplands in a few places. They formed under mixed prairie grasses in loess or silty water-laid material 40 to 60 inches thick and the underlying stratified loamy outwash.

In a representative profile, the surface layer is very dark grayish-brown silt loam about 12 inches thick. The subsoil is about 44 inches thick and is dark yellowish-brown. The upper 38 inches of the subsoil is silty clay loam, and the lower 6 inches is loam and sandy loam. Underlying the subsoil are thin layers of dark yellowish-brown loam, sandy loam, and silt loam.

Plano soils are high in organic-matter content and natural fertility. They have moderate permeability and high available water capacity.

Most areas of Plano soils are cultivated. These soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Plano silt loam, 0 to 2 percent slopes, in a cultivated field about 1.5 miles north of Middletown, 0.5 mile west and 50 feet south of the NW. corner of SE¼ sec. 6, T. 19 N., R. 4 W.:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, very fine, granular structure; friable; medium acid; abrupt, smooth boundary.

A1—8 to 12 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable; medium acid; clear, smooth boundary.

B1—12 to 18 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; dark-brown (10YR 3/3) splotches; moderate, very fine and fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21t—18 to 29 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, continuous, dark yellowish-brown (10YR 3/4) clay films; moderate, fine, subangular blocky structure; friable; medium acid; gradual, smooth boundary.

B22t—29 to 41 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, patchy, dark-brown (10 YR 3/3) clay films; weak, medium and coarse, subangular blocky structure; friable; medium acid; gradual, smooth boundary.

B31—41 to 50 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; few, patchy, dark-brown (10YR 3/3) clay films; weak, coarse, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

IIB32—50 to 54 inches, dark yellowish-brown (10YR 4/4) loam; weak, coarse, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

IIB33—54 to 56 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak, coarse, subangular blocky structure; friable; slightly acid; abrupt, smooth boundary.

IIC—56 to 60 inches, dark yellowish-brown (10 YR 4/4), stratified silt loam, loam, and sandy loam; massive; friable; slightly acid.

Color of the Ap and A1 horizons is very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2), and the combined thickness ranges from 10 to 15 inches. Texture of the IIB32 horizon ranges from clay loam to sandy loam. Depth to stratified loamy material ranges from 40 to 60 inches.

For unit 199C2, the combined thickness of the Ap horizon and A1 horizon is less than the range defined for the series, but this difference does not alter the usefulness or behavior of this soil.

Plano soils are on a landscape with Tama and Proctor soils. Plano soils differ from Tama soils because the lower part of their lower subsoil formed in stratified loamy outwash. Plano soils are similar to Proctor soils, but no part of the subsoil above a depth of 40 inches formed in loamy outwash.

Plano silt loam, 0 to 2 percent slopes (199A).—This soil has the profile described as typical for the series. It occupies large areas on stream terraces and some small areas on uplands.

Included in mapping are similar soils that have less clay in the subsoil. These inclusions are on broad, low terraces near streams. Also included are small areas of Elburn and Denny soils.

This soil is well suited to crops commonly grown in the county. It has few limitations and under proper management can be intensively cropped. Runoff is slow, but wetness is not a limitation. Management group I–2.

Plano silt loam, 2 to 4 percent slopes (199B).—This soil occupies small, isolated humps on stream terraces and short slopes on the edge of terraces. It also occupies small, isolated rises on uplands. It has a profile similar to the one described as representative for the series, but the surface layer is thinner.

Included in mapping are small areas of similar soils that have less clay in the subsoil. These inclusions occupy low terraces near streams. Also included are small areas where the surface layer is partly subsoil material.

This soil is suited to crops commonly grown in the county. Areas of this soil are small and are generally farmed in the same way as the surrounding nearly level soils. Slopes are short, and erosion is a hazard. An erosion control practice, such as contouring, will help to reduce soil losses. If properly managed, this soil can be intensively cropped. Management group IIe–2.

Plano silt loam, 4 to 7 percent slopes, eroded (199C2).—This soil occupies short slopes on the edge of terraces and along drainageways. It has a profile with a thinner surface layer than that described as representative for the series. The present surface layer is a mixture of the original dark-colored surface layer and part of the upper subsoil. The thickness of the present surface layer is about equal to the depth of plowing.

Included in mapping are small areas of soils that have slopes greater than 7 percent. Also included are small areas where the surface layer consists almost entirely of dark yellowish-brown subsoil material. Areas less than one acre in size that have a sandy surface layer are shown by a conventional symbol on the soil map.

This soil is suited to the crops commonly grown in the county. Erosion is a hazard. Unless protected from erosion, this soil is not suited to intensive cropping. Shape and shortness of slope restrict the use of some erosion control practices. Those practices that are adaptable will help to reduce soil losses. Management group IIe–2.

Proctor Series

The Proctor series consists of well drained and moderately well drained, nearly level to strongly sloping soils. These soils occupy many places on stream terraces, but they are also in a few places on uplands. They formed under mixed prairie grasses in loess or silty water-laid material 20 to 40 inches thick and the underlying stratified loamy outwash.

In a representative profile, the surface layer is very dark brown silt loam about 13 inches thick. The subsoil is about 42 inches thick. The upper 12 inches of the subsoil is dark-brown or brown silty clay loam, the next 12 inches is dark yellowish-brown or dark-brown clay loam, and the lower 18 inches is dark yellowish-brown or dark-brown sandy clay loam. The underlying material is dark yellowish-brown fine sand containing some fine gravel.

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Proctor soils are high in organic-matter content and natural fertility. They have moderate permeability and high available water capacity.

Most areas of Proctor soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Proctor silt loam, 0 to 2 percent slopes, in a cultivated field about 2 miles north of Middletown, 1,320 feet west and 40 feet south of the NE. corner of SE¼ sec. 6, T. 19 N., R. 4 W.:

Ap—0 to 8 inches, very dark brown (10YR 2/2) silt loam; weak, very fine and fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A3—8 to 13 inches, very dark brown (10YR 2/2) silt loam; weak and moderate, very fine and fine, granular structure; friable; medium acid; clear, smooth boundary.

B1—13 to 18 inches, dark-brown (10YR 4/3) light silty clay loam; thin, continuous, dark-brown (10YR 3/3) clay films; weak, very fine, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B21t—18 to 25 inches, dark-brown (10YR 4/3) silty clay loam; thin, continuous, dark-brown (10YR 3/3) clay films; weak, fine, subangular blocky structure; firm; medium acid; clear, smooth boundary.

IIB22t—25 to 30 inches, dark-brown (10YR 4/3) clay loam; thin, continuous, dark-brown (10YR 3/3) clay films; weak, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

IIB23t—30 to 37 inches, dark yellowish-brown (10YR 4/4) clay loam; thin, continuous, dark yellowish-brown (10YR 3/4) clay films; weak, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

IIB31—37 to 45 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; thin, continuous, dark yellowish-brown (10YR 3/4) clay films; weak, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

IIB32—45 to 55 inches, dark-brown (10YR 3/3) light sandy clay loam or fine gravelly loam; massive; friable, or sticky when wet; medium acid; abrupt, smooth boundary.

IIC—55 to 60 inches, dark yellowish-brown (10YR 4/4) fine sand; some fine gravel; single grain; loose; medium acid.

Color of the Ap and A3 horizons ranges from very dark brown (10YR 2/2) to dark brown (10YR 3/3), and the combined thickness of these horizons ranges from 10 to 15 inches. Texture of the B1 horizon ranges from heavy silt loam to silty clay loam. Texture of the IIB3 horizon is clay loam to sandy loam. Thickness of the solum ranges from 38 to 55 inches.

For units 148C2 and 148D2, the combined thickness of the Ap and A3 horizons and the thickness of the B horizon are less than the ranges defined for the series. These differences do not alter the usefulness or behavior of the soils.

Proctor soils are on a landscape with Brenton, Drummer, Plano, and Tama soils. They have better natural drainage than Brenton and Drummer soils and contain less clay in the surface layer than Drummer soils. In Proctor soils part of the subsoil above a depth of 40 inches formed in loamy material; in Plano soils it did not. Proctor soils have more sand in the subsoil than Tama soils.

Proctor silt loam, 0 to 2 percent slopes (148A).—This soil has the profile described as representative for the series. It occupies both large and small areas on high stream terraces and small areas on low terraces near streams.

Included in mapping are small areas of soils that contain material in the lower part of the subsoil that is coarser textured than that described as representative for the series. These included soils are on a stream terrace west of Lincoln and on a terrace along Salt Creek north of Middletown. Also included are small areas of Plano and Brenton soils. Areas less than an acre in size that have a sandy surface layer are shown by a conventional symbol on the soil map.

This soil is suited to the crops commonly grown in the county. It has few limitations and can be intensively cropped. Runoff is slow, but wetness is not a limitation. Management group I–2.

Proctor silt loam, 2 to 4 percent slopes (148B).—On stream terraces this soil commonly occupies small rises surrounded by other nearly level soils. It is also on slopes at the edge of terraces and old overflow channels. It has a profile similar to the one described as representative for the series, but the surface layer is thinner. This mapping unit includes small areas of soils having material in the lower part of their subsoil that is coarser than that described as representative for the series. Areas less than one acre in size that have a sandy or gravelly surface layer are shown by a conventional symbol on the soil map.

This soil is suited to the crops commonly grown in the county. Erosion is a hazard, but size and shape of slope limit the use of some erosion control practices. In most fields this soil is cultivated the same as surrounding nearly level soils. Where practical to use, erosion control practices such as contouring will help to reduce soil loss. Management group IIe–2.

Proctor silt loam, 4 to 7 percent slopes, eroded (148C2).—This soil occurs both on uplands and on stream terraces. On uplands it occupies short slopes facing large bottom lands. On stream terraces it mainly occupies short slopes on the terrace edges. It has a profile with a thinner surface layer and subsoil than those described as representative for the series. Plowing has mixed subsoil material into the surface layer. In places the subsoil is mottled.

Included in mapping are small areas of soils on terrace edges that have coarser textured material throughout the profile than is typical for the series. Also included are small areas that have a surface layer consisting almost entirely of subsoil material. Areas less than one acre in size that have a sandy or gravelly surface layer are shown by a conventional symbol on the soil map.

This soil is suited to the crops commonly grown in the county. Erosion is a hazard. Unless protected from erosion, this soil is not suited to intensive cropping. Slopes are short, but adapted erosion control practices will help to reduce soil and water losses. Management group IIe–2.

Proctor silt loam, 7 to 12 percent slopes, eroded (148D2).—This soil occupies short slopes on uplands and stream terraces. It commonly is on terrace edges. On uplands it occupies slopes facing large bottom lands. The surface layer of this soil is not as dark and the subsoil is thinner than those described as representative for the series. The thickness of the surface layer is about equal to the depth of plowing.

Included in mapping are small areas of soils that have coarser textured material throughout the profile than is typical for the series. Also included are small areas that have a surface layer consisting almost entirely of subsoil material. In places slopes exceed 12 percent.

This soil is suited to crops commonly grown in the county, but it is not suited to intensive cropping. Erosion is a hazard, and the surface layer is difficult to keep in good tilth. Adapted conservation practices will help to reduce soil and water losses. Management group IIIe–2.

Radford Series

The Radford series consists of somewhat poorly drained, nearly level soils on small bottom lands. These soils formed in water-laid materials consisting of silt loam over silty clay loam. The native vegetation was probably a mixture of grasses, sedges, and hardwood trees.

In a representative profile, the surface layer is very dark brown silt loam about 26 inches thick. The underlying material, to a depth of about 60 inches, is black silty clay loam.

Radford soils are high in organic-matter content and natural fertility. They have moderate permeability and high available water capacity.

Nearly all areas of Radford soils are cultivated, but some are in pasture. These soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Radford silt loam, in a cultivated field about 3.5 miles southeast of Middletown, in the NW. corner of NE¼SE¼ sec. 27, T. 19 N., R. 4 W.:

Ap—0 to 6 inches, very dark brown (10YR 2/2) silt loam; weak, thin, platy structure, breaking to weak, medium and fine, granular structure; friable; neutral; abrupt, smooth boundary.

A11—6 to 11 inches, very dark brown (10YR 2/2) silt loam; olive-brown (2.5Y 3/4) stains in old root channels; weak, medium, platy structure, breaking to weak, medium, granular structure; friable; neutral; clear, smooth boundary.

A12—11 to 21 inches, very dark brown (10YR 2/2) silt loam; common, fine, distinct, dark reddish-brown (5YR 2/2) mottles; weak, medium and thin, platy structure, breaking to weak, medium, granular structure; friable; neutral; clear, smooth boundary.

A13—21 to 26 inches, very dark brown (10YR 2/2) heavy silt loam; weak, medium, granular structure; friable; neutral; clear, smooth boundary.

A1b—26 to 60 inches, black (10YR 2/1) silty clay loam; weak, medium and fine, subangular blocky structure; firm; neutral.

Color of the Ap and A1 horizons is very dark brown (10YR 2/2) to black (10YR 2/1). Texture is typically silt loam, but thin strata of loam and sandy loam are included. Combined thickness of these horizons ranges from 15 to 40 inches. Reaction is slightly acid or neutral. The A1b horizon is typically silty clay loam but is silty clay in places.

Radford soils are on bottom lands with Lawson and Sawmill soils. Radford soils are similar to Lawson soils in natural drainage, but have silty clay loam at a depth above 40 inches. They have better natural drainage than Sawmill soils and do not contain as much clay in the upper part of the profile.

Radford silt loam (74).—This is the only Radford soil mapped in the county. It is nearly level and occupies areas along drainageways or similar areas on bottom lands where silty materials are deposited. Slope is less than 2 percent.

Included in mapping are small areas of Sawmill silt loam, overwash, and Lawson silt loam.

This Radford soil is suited to crops commonly grown in the county. Overflow is a hazard, runoff is slow, and many places are wet. This soil is suited to intensive cropping if it is protected from overflow, adequately drained, and otherwise well managed. Management group I–5.

Ross Series

The Ross series consists of well-drained, nearly level soils on bottom lands. These soils formed in water-laid materials. The native vegetation was probably a mixture of prairie grasses and hardwood trees.

In a representative profile, the surface layer is black and very dark brown loam about 33 inches thick. Below this, to a depth of about 60 inches, is very dark grayish-brown loam.

Ross soils are high in organic-matter content and natural fertility. They have moderate permeability and high available water capacity.

Most areas of Ross soils are cultivated and are well suited to corn, soybeans, oats, wheat, grasses, and legumes. Some small areas of these soils that are cut by overflow channels are idle or are in pasture.

Representative profile of Ross loam, in a cultivated field about 3.5 miles southeast of Hartsburg, about 1,980 feet east along the one-half mile line from the center of sec. 36, T. 21 N., R. 3 W.:

Ap—0 to 8 inches, black (10YR 2/1) loam; weak, very fine, granular structure; friable; medium acid; abrupt, smooth boundary.

A11—8 to 24 inches, black (10YR 2/1) loam; weak, very fine, granular structure; friable; medium acid; diffuse, smooth boundary.

A12—24 to 33 inches, very dark brown (10YR 2/2) loam; weak, very fine, granular structure; friable; slightly acid; diffuse, smooth boundary.

A13—33 to 50 inches, very dark grayish-brown (10YR 3/2) loam; weak, fine, granular structure; friable; slightly acid; diffuse, smooth boundary.

A14—50 to 60 inches, very dark grayish-brown (10YR 3/2) heavy loam; weak, fine, granular structure; friable; slightly acid.

Color of the Ap, A11, and A12 horizons is black (10YR 2/1) to very dark brown (10YR 2/2), and thickness ranges from 24 to 40 inches. Reaction ranges from medium acid to neutral. Color of the A13 and A14 horizons is very dark grayish brown (10YR 3/2) to dark brown (10YR 3/3).

Ross soils are on bottom lands with Huntsville and Lawson soils. They are similar to Huntsville soils but contain more sand. They have better natural drainage than Lawson soils.

Ross loam (73).—This is the only Ross soil mapped in the county. It occupies high areas in the bottom lands, and in many places it is near stream channels. Slope is less than 2 percent.

Included in mapping are small areas of Huntsville and Lawson soils. Areas less than one acre in size that have a sandy surface layer are shown on the soil map by a conventional symbol.

If protected from overflow and otherwise properly managed, this soil can be intensively cropped. There is a hazard of overflow, but only for short periods. Water is retained for longer periods in some of the overflow channels. This soil does not need artificial drainage. Areas that are inaccessible to farm equipment, because of meandering streams, are suited to permanent pasture or wildlife habitat. Management group I–3.

Rushville Series

The Rushville series consists of poorly drained soils in depressions. Most areas of these soils are on the upland, but a few are on stream terraces. Rushville soils formed under mixed hardwood trees in loess more than 60 inches thick.

In a representative profile, the surface layer is dark gray silt loam about 8 inches thick. The subsurface layer is grayish-brown silt loam about 8 inches thick. The subsoil is about 32 inches thick. The upper 14 inches of the subsoil is dark grayish-brown silty clay mottled with yellowish brown; the lower 18 inches is grayish-brown and light brownish-gray silty clay loam mottled with yellowish brown. Underlying the subsoil, to a depth of 60 inches, is gray and yellowish-brown silt loam.

Rushville soils are low in organic-matter content and moderate in natural fertility. They have slow or very slow permeability and high available water capacity.

Most areas of Rushville soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Rushville silt loam, in a cultivated field about 2.5 miles northwest of Lake Fork, in the SW¼ sec. 23, T. 18 N., R. 3 W., 400 feet west from farmstead lane and 336 feet south from center of east-west road:

Ap—0 to 8 inches, dark-gray (10YR 4/1) silt loam; moderate, very fine and fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A2—8 to 14 inches, grayish-brown (10YR 5/2) silt loam; moderate, thin, platy structure; friable; slightly acid; abrupt, wavy boundary.

AB—14 to 16 inches, grayish-brown (10YR 5/2) heavy silt loam; thin, continuous, dark-gray (10YR 4/1) clay films; many light-gray (10YR 7/1 when dry) silt grains; strong, very fine and fine, subangular blocky structure; friable; strongly acid; clear, wavy boundary.

B21tg—16 to 30 inches, dark grayish-brown (10YR 4/2) silty clay; thick, continuous, dark grayish-brown (10YR 4/2) clay films; many, medium, distinct, yellowish-brown (10YR 5/8) mottles; many dark reddish-brown (5YR 2/2) iron and manganese concretions; moderate, medium, prismatic structure where undisturbed, breaking to strong, medium, subangular blocky structure where disturbed; firm; strongly acid; clear, smooth boundary.

B22tg—30 to 39 inches, grayish-brown (10YR 5/2) silty clay loam; thick, continuous, dark-gray (10YR 4/1) and few black (10YR 2/1) clay films; few, medium, prominent, yellowish-red (5YR 5/6) mottles and many, medium, distinct, yellowish-brown (10YR 5/6) mottles; few black (5YR 2/1) iron and manganese concretions; weak, coarse, subangular blocky structure; firm; medium acid; gradual, smooth boundary.

B3g—39 to 48 inches, light brownish-gray (10YR 6/2) light silty clay loam; very dark gray (10YR 3/1) clay films in root pores; many, coarse, distinct, yellowish-brown (10YR 5/8) mottles; weak, coarse, subangular blocky structure; friable; neutral; abrupt, smooth boundary.

C—48 to 60 inches, mottled gray (10YR 6/1) and yellowish-brown (10YR 5/6 and 10YR 5/8) silt loam; massive; calcareous.

Color of the Ap horizon is dark gray (10YR 4/1) to dark grayish brown (10YR 4/2), and the thickness ranges from 6 to 8 inches. Color of the A2 horizon is gray (10YR 5/1) to grayish brown (10YR 5/2), and its thickness ranges from 4 to 10 inches. Texture of the B2 horizon ranges from light silty clay loam to silty clay.

Rushville soils are in patterns with Keomah and Clinton soils. They have a grayer subsurface layer and subsoil and poorer natural drainage than Keomah and Clinton soils.

Rushville silt loam (16).—This is the only Rushville soil mapped in the county. It generally occupies small depressions on the uplands. It also is on stream terraces, where it is slightly depressional or nearly level. Slope is less than one percent.

Included in mapping are small areas of Denny soils.

This soil is suited to crops commonly grown in the county. Wetness is the main limitation. Runoff is slow, or ponding occurs because natural outlets are not adequate.

Some type of drainage is needed if this soil is to be productive. Tile drains do not function properly, because of slow permeability. Tile inlets or shallow surface ditches will help drain this soil. Crusts form easily on the surface. Additions of organic matter improve tilth. Management group IIw–3.

Russell Series

The Russell series consists of well-drained, moderately steep soils. These soils are on uplands in the northeastern part of the county, mainly in Eminence and Atlanta Townships. They formed under mixed hardwood trees in 20 to 40 inches of loess and the underlying glacial till.

In a representative profile, the surface layer is dark grayish-brown silt loam about 7 inches thick. The subsoil is about 41 inches thick. Its upper 20 inches is dark yellowish-brown silty clay loam and the lower 21 inches is olive-brown clay loam. Underlying the subsoil, to a depth of about 60 inches, is light olive-brown loam.

Russell soils are low in organic-matter content and moderate in natural fertility. They have moderate permeability and high available water capacity. Unless previously treated, these soils need lime.

Some areas of Russell soils are cultivated, and some are in pasture or woodland. These soils are suited to oats, wheat, grasses, and legumes.

In Logan County, Russell soils are so closely intermingled with Miami soils that they were mapped in a complex with those soils. For a description of that complex, see the Miami series.

Representative profile of Russell silt loam from an area of Miami-Russell silt loams, 12 to 18 percent slopes, eroded, in a cultivated field about 3.5 miles southeast of Atlanta, 456 feet north and 75 feet east of the SW. corner of NW¼ sec. 25, T. 21 N., R. 1 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) heavy silt loam; moderate, fine, granular structure; friable; neutral; abrupt, smooth boundary.

B21t—7 to 12 inches, dark yellowish-brown (10YR 4/4) heavy silty clay loam; thin, continuous, dark grayish-brown (10YR 4/2) clay films; moderate, very fine and fine, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B22t—12 to 20 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, continuous, dark grayish-brown (10YR 4/2) clay films; moderate, fine and medium, subangular blocky structure; firm; strongly acid; clear, smooth boundary.

B23t—20 to 27 inches, dark yellowish-brown (10YR 4/5) silty clay loam; thin, discontinuous, dark grayish-brown (10YR 4/2) clay films; moderate, fine, prismatic structure; firm; medium acid; abrupt, smooth boundary.

IIB24t—27 to 36 inches, olive-brown (2.5Y 4/4) clay loam; brown (10YR 4/3) clay films on vertical faces of peds; moderate, medium, prismatic structure; firm; medium acid; clear, smooth boundary.

IIB3—36 to 48 inches, olive-brown (2.5Y 4/4) light clay loam; weak, coarse, prismatic structure; friable; neutral; abrupt, smooth boundary.

IIC1—48 to 55 inches, light olive-brown (2.5Y 5/4) loam; few, medium, faint, light olive-brown (2.5Y 5/6) mottles; massive; friable; calcareous; clear, wavy boundary.

IIC2—55 to 60 inches, light olive-brown (2.5Y 5/4) loam; massive; friable; calcareous.

Color of the Ap horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). Texture ranges from silt loam to silty clay loam. Thickness of the Ap horizon is about equal to the depth of plowing. Depth to calcareous till ranges from 42 to 54 inches. The IIC2 horizon is silt loam in some places.

Russell soils are on a landscape with Miami, Hennepin, and Birkbeck soils. They are similar in natural drainage to Miami and Hennepin soils, but the upper part of their subsoil formed in loess and they have a greater depth to calcareous till. Russell soils have better natural drainage than Birkbeck soils.

Sable Series

The Sable series consists of poorly drained, nearly level soils. These soils are mainly on uplands, but some areas are on stream terraces. Sable soils formed under slough grasses and sedges in loess more than 60 inches thick.

In a representative profile, the surface layer is black silty clay loam about 20 inches thick (fig. 11). The lower 4 inches has light brownish-gray splotches. The subsoil is dark-gray and gray silty clay loam mottled with strong brown and yellowish brown and is about 31 inches thick. The underlying material, to a depth of about 60 inches, is gray silt loam mottled with yellowish brown.

Sable soils are high in organic-matter content and natural fertility. They have moderate permeability and very high available water capacity.

Most areas of Sable soils are cultivated. These soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Sable silty clay loam, in a cultivated field about 2 miles southeast of Broadwell, 660 feet

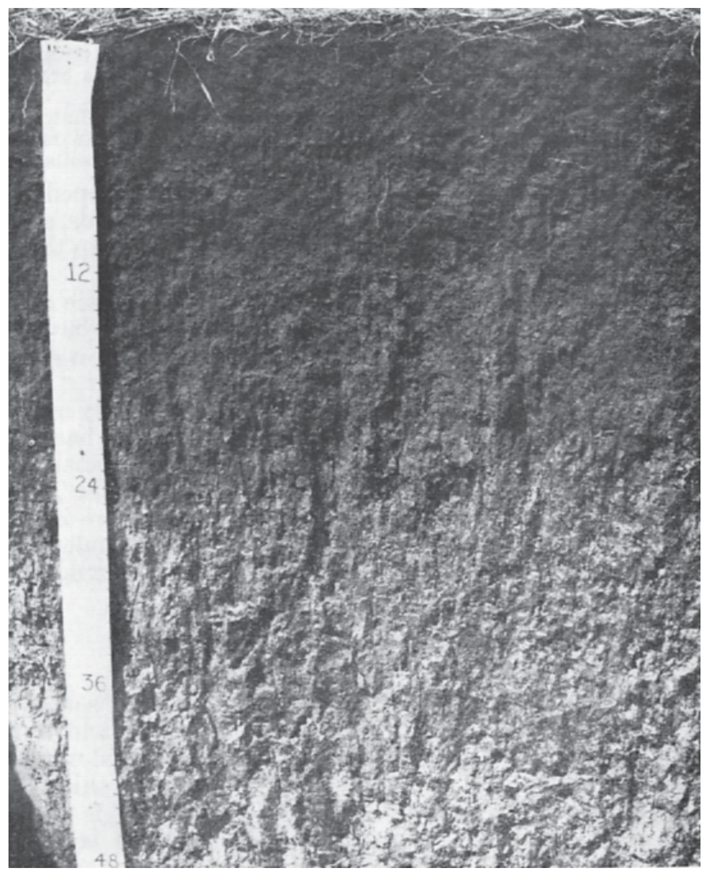

Figure 11.—**Profile of Sable silty clay loam.**

north and 65 feet east from a road corner near the middle of SW¼ sec. 3, T. 18 N., R. 3 W.:

Ap—0 to 7 inches, black (10YR 2/1) silty clay loam; moderate, very fine and fine, granular structure and some moderate, fine, angular blocky structure; friable; neutral; abrupt, smooth boundary.

A1—7 to 16 inches, black (10YR 2/1) silty clay loam; few strong-brown (7.5YR 5/8) iron and manganese concretions; moderate, very fine, subangular blocky structure; friable; neutral; clear, smooth boundary.

A3—16 to 20 inches, black (10YR 2/1) silty clay loam; light brownish-gray (10YR 6/2) splotches; moderate, fine and medium, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B21g—20 to 27 inches, dark-gray (10YR 4/1) silty clay loam; thin, continuous, dark-gray (10YR 4/1) clay films; common, medium, distinct, yellowish-brown (10YR 5/4) mottles and few, fine, distinct, light-gray (10YR 7/2) mottles; moderate, medium, prismatic structure where undisturbed, breaking to moderate, coarse, subangular blocky structure; firm; slightly acid; gradual, smooth boundary.

B22g—27 to 36 inches, gray (5Y 5/1) silty clay loam; thin, discontinuous, dark-gray (10YR 4/1) clay films; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; few strong-brown (7.5YR 5/8) iron and manganese concretions; moderate, medium, prismatic structure; firm; neutral; gradual, smooth boundary.

B3g—36 to 51 inches, gray (5Y 5/1) silty clay loam; thin, discontinuous, dark-gray (10YR 4/1) clay films; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; weak, coarse, prismatic structure; firm; neutral; gradual, smooth boundary.

Cg—51 to 60 inches, gray (5Y 5/1) heavy silt loam; common, medium, distinct, yellowish-brown (10YR 5/8) mottles; massive; calcareous.

Color of the Ap, A1, and A3 horizons is black (10YR 2/1) to very dark gray (10YR 3/1). Texture is typically silty clay loam, but it ranges from heavy silt loam to heavy silty clay loam. Combined thickness of the Ap, A1, and A3 horizons ranges from 15 to 23 inches.

Sable soils are on a landscape with Ipava, Tama, Harpster, Hartsburg, and Shiloh soils. They contain more clay in the surface layer and have poorer natural drainage than Ipava and Tama soils. Sable soils are similar to the Harpster and Hartsburg soils but are not calcareous above a depth of 35 inches. They do not have as thick a surface layer and do not contain as much clay as Shiloh soils.

Sable silty clay loam (68).—This is the only Sable soil mapped in the county. It occupies drainageways, small depressions, and large nearly level areas throughout the county. Slope rarely exceeds 2 percent.

Included in mapping is a small acreage of soils having a high sand content below the subsoil. These included soils are in the northwestern part of the county on a landscape with Lawndale and Broadwell soils. Also included are small areas of silty overwash and small areas of Ipava, Hartsburg, Harpster, and Shiloh soils. Wet areas less than one acre in size are shown on the soil map by a conventional symbol.

This soil is suited to crops commonly grown in the county. Wetness is a limitation. Runoff is slow or ponded. Tile drains and shallow surface ditches will improve drainage. If the surface layer is worked when too wet, it becomes cloddy. Careful management is required where this soil is intensively cropped. Management group IIw–1.

St. Charles Series

The St. Charles series consists of well drained and moderately well drained, nearly level to moderately sloping soils. These soils are mainly on stream terraces, but they are also on uplands. They formed under mixed hardwood trees in loess or silty water-laid material 40 to 60 inches thick and the underlying stratified outwash.

In a representative profile, the surface layer is dark grayish-brown silt loam about 7 inches thick. The subsoil is about 58 inches thick. In sequence from the top, the uppermost 19 inches is mainly dark-brown silty clay loam, the next 19 inches is dark yellowish-brown silty clay loam, and the lower 20 inches is dark-brown sandy clay loam and sandy loam. The underlying material, to a depth of about 70 inches, is dark-brown sand containing some fine gravel.

St. Charles soils are low in organic-matter content and moderate in natural fertility. They have moderate permeability and high available water capacity. Unless previously treated, these soils need lime.

Most areas of St. Charles soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of St. Charles silt loam, 1 to 4 percent slopes, in a cultivated field about 1.5 miles west of Chestnut, 453 feet west and 57 feet north of the center of sec. 33, T. 19 N., R. 1 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, thick, platy structure, breaking to weak, very fine, granular structure; friable; neutral; abrupt, smooth boundary.

B1—7 to 10 inches, yellowish-brown (10YR 5/4) light silty clay loam; very pale-brown (10YR 7/3 when dry) silt coatings; black (10YR 2/1) iron and manganese concretions; weak, fine, subangular blocky structure; friable; neutral; clear, smooth boundary.

B21t—10 to 15 inches, dark-brown (7.5YR 4/4) silty clay loam; thin, discontinuous, dark-brown (7.5YR 3/2) clay films; pale-brown (10YR 6/3 when dry), discontinuous silt coatings; moderate, fine, subangular blocky structure; firm; very strongly acid; clear, smooth boundary.

B22t—15 to 26 inches, dark-brown (7.5YR 4/4) silty clay loam; dark-brown (7.5YR 3/2) clay films; light-gray (10YR 7/2 when dry) silt coatings; strong, fine and medium, subangular and angular blocky structure; firm; very strongly acid; gradual, smooth boundary.

B23t—26 to 33 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; thin, continuous dark-brown (7.5YR 4/4) clay films; few black (10YR 2/1) iron and manganese concretions; moderate, medium, subangular and angular blocky structure; firm; very strongly acid; gradual, smooth boundary.

B24t—33 to 45 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; thin, continuous, dark-brown (7.5YR 4/4) clay films; moderate, medium and coarse, subangular blocky structure; friable; very strongly acid; clear, smooth boundary.

IIB31—45 to 48 inches, dark yellowish-brown (10YR 4/4) sandy clay loam or clay loam; thin, discontinuous, dark-brown (7.5YR 4/4) clay films; weak, coarse, subangular blocky structure; friable; very strongly acid; clear, smooth boundary.

IIB32—48 to 59 inches, dark-brown (7.5YR 4/4) heavy sandy loam; few dark-brown (7.5YR 3/2) streaks; weak, coarse, subangular blocky structure; friable; very strongly acid; gradual, smooth boundary.

IIB33—59 to 65 inches, dark-brown (7.5YR 4/4) sandy loam; considerable amount of medium gravel; few dark-brown (7.5YR 3/2) streaks; weak, coarse, subangular blocky structure; friable; very strongly acid; clear, smooth boundary.

IIC—65 to 70 inches, dark-brown (7.5YR 4/4) medium sand; some fine gravel; few dark-brown (7.5YR 3/3) iron bands; single grain; loose, strongly acid.

Color of the Ap horizon is dark grayish brown (10YR 4/2) to dark brown (10YR 4/3). Texture ranges from silt loam to light silty clay loam. Thickness ranges from about 7 to 10 inches. In most areas that are not cultivated, there is an A2 horizon. Where present, this horizon is 3 to 5 inches thick and is yellowish brown (10YR 5/4) to brown (10YR 5/3). At least the upper 40 inches of the solum formed in loess or silty water-laid material. Texture of the B3 horizon ranges from clay loam to sandy loam. Depth to stratified loamy material ranges from 40 to 60 inches.

St. Charles soils are on a landscape with Thebes and Fayette soils and have similar natural drainage. They differ from Thebes soils because they have less sand in the subsoil above a depth of 40 inches. St. Charles soils contain more sand in the lower part of the subsoil than Fayette soils.

St. Charles silt loam, 1 to 4 percent slopes (243B).—This soil has the profile described as representative for the series. It commonly is on stream terraces but is also on the uplands. It occupies small, nearly level areas and gentle slopes along drainageways and on small ridges.

Included in mapping are small areas of somewhat poorly drained soils. Also included are small areas of eroded soils.

This soil is suited to crops commonly grown in the county. Erosion is a hazard. Low fertility and poor tilth are limitations, and crusts form easily on the surface layer. Additions of organic matter will help improve tilth and fertility. This soil is suited to intensive cropping if erosion control measures and other management practices are applied. Management group IIe–1.

St. Charles silt loam, 4 to 7 percent slopes, eroded (243C2).—The profile of this soil is similar to that described as representative for the series, but the subsoil is thinner and the surface layer is partly subsoil material. Plowing has mixed part of the upper subsoil with the original surface and subsurface layers.

Included in mapping are small areas of soils where the surface layer consists almost entirely of subsoil material. Also included are small areas of a soil that is only slightly eroded.

This St. Charles soil is suited to crops commonly grown in the county. Erosion is a hazard. Low fertility and poor tilth are limitations, and crusts form easily on the surface. Short slopes limit the use of some erosion control practices. Additions of organic matter help improve tilth and fertility. This soil is suited to intensive cropping if erosion control measures and other management practices are applied. Management group IIe–1.

Sawmill Series

The Sawmill series consists of poorly drained soils that formed in silty clay loam water-laid sediments. These soils are nearly level and also occur in depressions. They probably formed under vegetation that included slough grasses, sedges, and hardwood trees.

In a representative profile, the surface layer is silty clay loam about 27 inches thick. The upper 20 inches is black, and the lower 7 inches is very dark gray. The subsoil is about 16 inches thick. The upper 5 inches of the subsoil is dark-gray silty clay loam mottled with light olive brown, and the lower 11 inches is mixed gray and yellowish-red silty clay loam. Underlying the subsoil, to a depth of about 60 inches, is light-gray or gray silty clay loam.

Sawmill soils are high in organic-matter content and natural fertility. They have moderate to moderately slow permeability and very high available water capacity.

Most areas of Sawmill soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Sawmill silty clay loam, in a cultivated field about 1.5 miles south of Lincoln, 743 feet west and 60 feet south of the SE. corner of NE¼ sec. 12, T. 19 N., R. 3 W.:

Ap—0 to 8 inches, black (10YR 2/1) silty clay loam; moderate, very fine, subangular blocky and moderate, fine, granular structure; firm; neutral; abrupt, smooth boundary.

A11—8 to 15 inches, black (10YR 2/1) silty clay loam; moderate, very fine, subangular blocky structure; firm; neutral; clear, smooth boundary.

A12—15 to 20 inches, black (10YR 2/1) silty clay loam; moderate, fine, subangular blocky structure; neutral; clear, smooth boundary.

A3—20 to 27 inches, very dark gray (10YR 3/1) heavy silty clay loam; moderate, medium, prismatic structure, breaking to moderate, medium, subangular blocky structure; firm; neutral; clear, smooth boundary.

B21g—27 to 32 inches, dark-gray (10YR 4/1) heavy silty clay loam; common, fine, distinct, light olive-brown (2.5Y 5/6) mottles; black (10YR 2/1) clay coatings in root and worm channels; moderate, medium, prismatic structure; firm; neutral; clear, smooth boundary.

B22g—32 to 43 inches, mixed gray (5Y 5/1) and yellowish-red (5YR 5/8) silty clay loam; black (10YR 2/1) clay coatings in root and worm channels; weak, medium, prismatic structure; neutral; clear, smooth boundary.

Cg—43 to 60 inches, light-gray or gray (5Y 6/1) light silty clay loam; massive; friable; neutral.

Color of the Ap, A1, and A3 horizons is black (10YR 2/1) to very dark gray (10YR 3/1). Texture is typically silty clay loam, but in places it is clay loam or silt loam. Combined thickness of the Ap, A1, and A3 horizon ranges from 24 to 40 inches. Texture of the B horizon ranges from light to heavy silty clay loam. Texture of the C horizon ranges from light silty clay to sandy loam.

Sawmill soils are on bottom lands with Lawson and Radford soils. They contain more clay and have poorer natural drainage than Lawson soils. They are more poorly drained than Radford soils and are not as silty in the A horizons.

Sawmill silty clay loam (107).—This soil has the profile described as representative for the series. It occupies large, broad areas on the bottom lands and narrow areas along the base of slopes where uplands join the bottom lands. Slope is less than 2 percent.

Included in mapping are small areas of a clay loam soil on bottom lands along Kickapoo Creek west of Lincoln and in some areas along Prairie Creek. Also included are small areas of Shiloh silty clay loam and small areas where the surface layer is less than 24 inches thick.

This soil is well suited to crops commonly grown in the county and can be intensively cropped. Overflow is a hazard, and runoff is slow. In places this soil is subject to ponding and to runoff from nearby uplands. The surface layer becomes cloddy if worked when too wet. Tile drains and shallow surface ditches can be used to improve drainage. Management group IIw–2.

Sawmill silt loam, overwash (107+).—This soil is in drainageways and on bottom lands along small streams. It is also in areas on larger bottom lands at the base of upland slopes. Slopes in most places are less than 2 percent. This soil has a profile similar to the one described as representative for the series, but dark-colored, silty deposits 8 to 14 inches thick overlie the silty clay loam surface layer.

Included in mapping are small areas of Radford silt loam, Lawson silt loam, and areas where the surface material is light-colored silty overwash.

This soil is well suited to crops commonly grown in the county and can be intensively cropped. Annual overflow is a hazard, and runoff is slow. In places this soil is subject to ponding and to runoff from nearby uplands. The surface layer does not clod as easily as that of Sawmill silty clay loam. Tile drains and shallow surface ditches can be used to improve drainage. Management group IIw-2.

Shiloh Series

The Shiloh series consists of very poorly drained soils. These soils are mainly in depressions on uplands. They formed under slough grasses and sedges in more than 60 inches of loess or silty water-laid material.

In a representative profile, the surface layer is black heavy silty clay, loam and silty clay about 32 inches thick. The subsoil is about 28 inches thick and is mainly gray silty clay loam mottled with yellowish brown. Underlying the subsoil, to a depth of about 70 inches, is gray silt loam mottled with yellowish brown.

Shiloh soils are high in organic-matter content and natural fertility. They have slow or moderately slow permeability and high available water capacity.

Most areas of Shiloh soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Shiloh silty clay loam, in a cultivated field about 1.25 miles north of Lincoln, 1,320 feet north and 70 feet west of the SE. corner of SW¼ sec. 18, T. 20 N., R. 2 W.:

Ap—0 to 8 inches, black (10YR 2/1) heavy silty clay loam; moderate, fine, granular structure; firm; neutral; abrupt, smooth boundary.

A11—8 to 19 inches, black (10YR 2/1) silty clay; moderate, fine, angular blocky structure; firm; slightly acid; smooth boundary.

A12—19 to 32 inches, black (10YR 2/1) silty clay; moderate, medium, subangular blocky structure; firm; slightly acid; gradual, smooth boundary.

B1g—32 to 34 inches, very dark gray (10YR 3/1) silty clay; gray (5Y 5/1) specks; weak to moderate, fine, subangular blocky structure; firm; slightly acid; clear, smooth boundary.

B2g—34 to 46 inches, gray (5Y 5/1) heavy silty clay loam; thin, discontinuous, dark grayish-brown (10YR 4/2) and very dark gray (10YR 3/1) clay films; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, fine and medium, subangular blocky structure; firm; neutral; gradual, smooth boundary.

B3g—46 to 60 inches, gray (5Y 5/1) silty clay loam; thin, discontinuous, dark grayish-brown (10YR 4/2) and very dark gray (10YR 3/1) clay films; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure; firm; neutral; gradual, smooth boundary.

Cg—60 to 70 inches, gray (5Y 5/1) silt loam; many, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; friable; neutral.

Colors of the Ap and A1 horizons are black (10YR 2/1) to very dark gray (10YR 3/1). Texture ranges from heavy silty clay loam to silty clay, and thickness is 26 to 38 inches. Texture of the B horizon ranges from silty clay loam to silty clay.

Shiloh soils are in patterns with Sable, Hartsburg, Harpster, and Ipava soils. They contain more clay and have a thicker surface layer than Sable soils. They contain more clay than Hartsburg and Harpster soils and, unlike those soils, are not calcareous above a depth of 35 inches. Shiloh soils have poorer natural drainage, have a thicker surface layer, and contain more clay than Ipava soils.

Shiloh silty clay loam (138).—This is the only Shiloh soil mapped in the county. This soil is generally in closed depressions on uplands, and many areas are less than one acre in size. In places the soil occupies large, nearly level areas. A few areas are on stream terraces. Slope is less than 2 percent.

Included in mapping are small areas of a similar soil on bottom land that contains more sand in the lower part of the profile than this soil. Also included are small areas of calcareous soils. These are shown on the soil map by a special symbol.

If this Shiloh soil is adequately drained and otherwise properly managed, it is suited to crops commonly grown in the county. Wetness is a limitation in most places. Overflow is a hazard on the bottom land. Runoff is slow, and ponding occurs because natural outlets are lacking. Artificial drainage is needed if this soil is to be productive. Tile drains do not function well, but tile inlets or shallow surface ditches can be used to improve drainage. The surface layer becomes cloddy if worked when too wet. Management group IIw-1.

Sylvan Series

The Sylvan series consists of well-drained, moderately steep to very steep soils. These soils are common on uplands along Salt Creek in Corwin Township. They formed under mixed hardwood trees in loess more than 60 inches thick.

In a representative profile, the surface layer is dark grayish-brown silt loam about 5 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is dark yellowish-brown silty clay loam and is about 23 inches thick. The underlying material, to a depth of 60 inches, is yellowish-brown silt loam.

Sylvan soils are low in organic-matter content and moderate in natural fertility. They have moderate permeability and high available water capacity.

Most areas of Sylvan soils are in pasture or woodland and are suited to these uses. In Logan County, Sylvan soils were mapped only in an undifferentiated group with Hickory soils. This mapping unit is described under the Hickory series.

Representative profile of Sylvan silt loam from an area of Hickory and Sylvan soils, 15 to 50 percent slopes, eroded, in a pasture about 3.5 miles northwest of Broadwell, 249 feet in a southeasterly direction from the southeast corner of cemetery, and midway on slope of drainageway in the NE¼NE¼ sec. 12, T. 19 N., R. 4 W.:

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) when dry; moderate, very fine, granular structure; friable; slightly acid; clear, smooth boundary.

A2—5 to 9 inches, brown (10YR 5/3) silt loam; splotches of dark grayish brown (10YR 4/2); moderate, medium, granular structure; friable; medium acid; clear, smooth boundary.

B1—9 to 13 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; many light-gray (10YR 7/2 when dry) silt coatings; moderate; very fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21t—13 to 19 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, discontinuous, dark-brown or brown (10YR 4/3) clay films; many light-gray (10YR 7/2 when dry) silt coatings; moderate, very fine and fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B22t—19 to 26 inches, dark yellowish-brown (10YR 4/4) silty clay loam; patchy, dark-brown (10YR 4/3) clay films; moderate, medium and coarse, subangular blocky structure; friable; neutral; clear, smooth boundary.

B3—26 to 32 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; patchy, dark-brown (10YR 3/3) clay films; weak, coarse, subangular blocky structure; friable; neutral; clear, smooth boundary.

C—32 to 60 inches, yellowish-brown (10YR 5/4) silt loam; massive; very friable; calcareous; a few lime concretions are also present.

Color of the A1 horizon ranges from grayish brown (10YR 4/2) to dark yellowish brown (10YR 4/4). Thickness ranges from 3 to 6 inches. Color of the A2 horizon is brown (10YR 5/3) to yellowish brown (10YR 5/4). Thickness ranges from 3 to 5 inches. The A1 and A2 horizons are mixed or absent where the soils are eroded. Texture of the B horizon ranges from heavy silt loam to silty clay loam. Depth to calcareous loess ranges from about 25 to 40 inches.

Sylvan soils are next to Hickory soils. They have similar natural drainage, but Sylvan soils formed in loess and Hickory soils formed in glacial till. Sylvan soils have natural drainage similar to that of the Tallula and Bold soils, which formed in loess on another landscape, but Sylvan soils have more clay in the layers below the surface layer. They also have a thinner and lighter colored surface layer than Tallula soils.

Tallula Series

The Tallula series consists of well drained and moderately well drained, strongly sloping and moderately steep soils on uplands. These soils are common in Corwin Township. They formed under mixed prairie grasses in loess more than 60 inches thick.

In a representative profile, the surface layer is very dark-brown silt loam about 10 inches thick. The subsoil is dark-brown and dark yellowish-brown silt loam about 18 inches thick. Underlying the subsoil, to a depth of about 60 inches, is yellowish-brown and brown silt loam.

Tallula soils are high in organic-matter content and natural fertility. They have moderate permeability and high available water capacity.

Most areas of Tallula soils are cultivated, but a few areas are in pasture. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

In Logan County, Tallula soils are so closely intermingled with Bold soils that they were mapped in a complex with those soils.

Representative profile of Tallula silt loam from an area of Tallula-Bold silt loams, 6 to 15 percent slopes, eroded, in a cultivated field about 2 miles south of Hartsburg, 660 feet north and 26 feet east of the SW. corner of sec. 33, T. 21 N., R. 3 W.:

Ap—0 to 10 inches, very dark brown (10YR 2/2) silt loam; weak and moderate, fine and very fine, granular structure; friable; neutral; abrupt, smooth boundary.

B1—10 to 14 inches, dark-brown (10YR 4/3) silt loam; some very dark grayish-brown (10YR 3/2) organic films; moderate, medium, granular structure; friable; neutral; clear, smooth boundary.

B2—14 to 23 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; weak, medium, subangular blocky structure; friable; neutral; gradual, smooth boundary.

B3—23 to 28 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine, granular structure; friable; neutral; abrupt, wavy boundary.

C1—28 to 35 inches, yellowish-brown (10YR 5/4) silt loam; few, fine, distinct, yellowish-brown (10YR 5/8) mottles and few, fine, distinct, light brownish-gray (10YR 6/2) mottles; massive; friable; calcareous; gradual, smooth boundary.

C2—35 to 60 inches, brown (10YR 5/3) silt loam; few, medium, distinct, yellowish-brown (10YR 5/8) mottles; massive; friable; calcareous.

Color of the AP horizon ranges from black (10YR 2/1) to dark brown (10YR 3/3), and thickness ranges from 8 to 12 inches. Total thickness of the B horizon ranges from 10 to 25 inches. Depth to calcareous loess ranges from 18 to 35 inches.

Tallula soils are next to Bold soils on the landscape. Elkhart and Tama soils are nearby. All these soils formed in loess, but Tallula soils are deeper to calcareous loess and have a darker and thicker surface layer than Bold soils. They have less clay in the subsoil than the Tama and Elkhart soils.

Tallula-Bold silt loams, 6 to 15 percent slopes, eroded (965D2).—These soils occupy short side slopes of drainageways, some of which face the bottom lands. About 70 percent of the mapping unit is Tallula silt loam, and nearly 30 percent is Bold silt loam.

Included in mapping are small areas of Elkhart and Tama soils.

Soils of this complex are suited to crops commonly grown in the county, but they are not suited to intensive cropping. Short slopes limit the use of some erosion measures. Suitable erosion control practices, such as minimum tillage, help to reduce soil losses. Bold silt loam contains more lime than Tallula silt loam but is lower in organic-matter content and natural fertility. Management group IIIe-2.

Tama Series

The Tama series consists of well-drained, nearly level to strongly sloping soils on uplands and terraces. These soils formed under mixed prairie grasses in loess more than 60 inches thick. They are common throughout the county.

In a representative profile, Tama soils have a very dark brown silt loam surface layer about 13 inches thick. The subsoil is silty clay loam and is about 40 inches thick. The upper 5 inches of the subsoil is dark brown, the next 17 inches is dark yellowish brown, and the lower 18 inches is yellowish brown mottled with pale brown (fig. 12). Underlying the subsoil, to a depth of 60 inches, is yellowish-brown silt loam mottled with pale brown.

Tama soils are high in organic-matter content and natural fertility. They have moderate permeability and very high available water capacity.

Nearly all the acreage of Tama soils is cultivated. These soils are well suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Tama silt loam, 2 to 4 percent slopes, in a cultivated field about 2.5 miles west of Mt. Pulaski, 660 feet north and 40 feet east of SW. corner of SE1/4 sec. 17, T. 18 N., R. 2 W.:

Ap—0 to 8 inches, very dark brown (10YR 2/2) silt loam; weak, very fine, granular structure; friable; medium acid; abrupt, smooth boundary.

A1—8 to 13 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and medium, granular structure; friable; medium acid; clear, smooth boundary.

B1—13 to 18 inches, dark brown (10YR 4/3) light silty clay loam; moderate, very fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21t—18 to 27 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, discontinuous, dark-brown (10YR 3/3) clay films; moderate, fine and medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

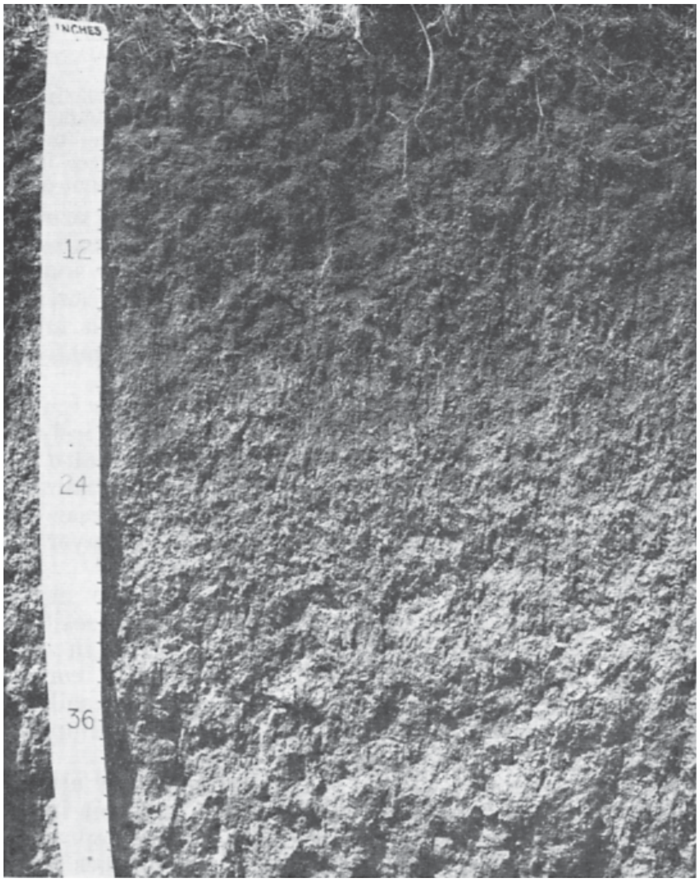

Figure 12.—**Profile of a Tama silt loam.**

B22t—27 to 35 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, discontinuous, dark-brown (10YR 3/3) clay films and few, fine, faint, yellowish-brown (10YR 5/6) and pale-brown (10YR 6/3) mottles; moderate, medium and coarse, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B3—35 to 53 inches, yellowish-brown (10YR 5/4) light silty clay loam; common, fine, faint, yellowish-brown (10YR 5/6) mottles, and common, medium, faint, pale-brown 10YR 6/3) mottles; weak, coarse, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

C—53 to 60 inches, yellowish-brown (10YR 5/4) silt loam; common, medium, faint, yellowish-brown (10YR 5/6) mottles, and many, medium, faint, pale-brown (10YR 6/3) mottles; a few black (5YR 2/1 iron and manganese concretions; massive; friable; neutral.

Color of the Ap and A1 horizons ranges from very dark brown (10YR 2/2) to dark brown (10YR 3/3), and the combined thickness of these horizons ranges from 10 to 17 inches. In some profiles the lower part of the subsoil is mottled with pale brown (10YR 6/3). Depth to the C horizon ranges from 40 to 60 inches.

For mapping units 36C2 and 36D2, the combined thickness of the Ap and A1 horizons is less than the range defined for the series. This difference does not significantly alter the usefulness or behavior of these soils.

Tama soils are on landscapes with Ipava, Sable, and Catlin soils on the uplands and with Plano soils on stream terraces. Tama soils have better natural drainage than Ipava and Sable soils and contain less clay in the surface layer than Sable soils. They are similar in natural drainage to Plano and Catlin soils, but they have less sand in the lower part of the subsoil and underlying material.

Tama silt loam, 0 to 2 percent slopes (36A).—The profile of this soil is similar to the one described as representative for the series, but the surface layer is thicker. In places the subsoil is not mottled. On the uplands this soil lies in small, nearly level areas among areas of more sloping soils. In some areas it is on small rises among larger areas of poorly drained soils. Larger areas of this soil are on terraces.

Included in mapping are small areas of Ipava, Muscatine, and Denny soils. Also included are areas of soils that are similar to this Tama soil but are moderately well drained. Wet areas less than one acre in size are shown by a conventional symbol on the soil map.

This soil is suited to crops commonly grown in the county. It has few limitations and can be intensively cropped. Proper management will maintain fertility and organic-matter content. Management group I–2.

Tama silt loam, 2 to 4 percent slopes (36B).—This is the most extensive Tama soil in the county, and it has the profile described as representative for the series. This soil lies on crests of narrow, irregularly shaped ridgetops; on broad, uniform slopes on morainal ridges; on gentle rises on nearly level landscapes; and on side slopes of drainageways.

Included in mapping are small areas where slopes are less than 2 percent and some where slopes are more than 4 percent. Small eroded areas are also included, and there are inclusions of soils that are similar to this Tama soil but are moderately well drained. In places the subsoil is not mottled.

Properly managed, this soil can be used intensively for crops commonly grown in the county. Erosion is a hazard. Terracing, contouring, minimum tillage, conservation of residue, and grassed waterways help to reduce soil losses. Management group IIe–2.

Tama silt loam, 4 to 7 percent slopes, eroded (36C2).—This soil lies on short side slopes of drainageways and, in places, below areas of gently sloping soils. Its profile has a thinner surface layer than the profile described as representative for the series. The present surface layer is a mixture of the original surface layer and the upper part of the subsoil. Its thickness is about equal to the depth of plowing.

Included in mapping are small areas where the surface layer is as thick as that of the representative profile. Also included are small areas where the surface layer consists almost entirely of yellowish-brown subsoil material. In addition, there are inclusions of soils that are similar to this Tama soil but are moderately well drained.

This soil is suited to crops commonly grown in the county. Unless it is protected from erosion, however, this soil is not suited to intensive cropping. Terracing, contouring, minimum tillage, conservation of residue, and grassed waterways help to control erosion. Short slopes limit the use of some erosion control practices. Management group IIe–2.

Tama silt loam, 7 to 12 percent slopes, eroded (36D2).—This soil lies on short side slopes of drainageways. Its profile has a thinner surface layer than the profile described as representative for the series. Thickness of the surface layer is about equal to the depth of plowing. Plowing has mixed subsoil material with what remains of the original surface layer. The present surface layer is lower in organic-matter content than the original surface layer.

Included in mapping are small areas where the surface layer is as thick as that of the representative profile. Also included are small areas where the surface layer consists almost entirely of dark yellowish-brown subsoil material, and areas of soils that are similar to this Tama soil but are moderately well drained.

This soil is suited to crops commonly grown in the county. It is not suited to intensive cropping, however, because erosion is a hazard and poor tilth is a problem. Erosion control practices help to reduce soil losses. Additions of organic matter increase fertility and improve tilth. Management group IIIe–2.

Thebes Series

The Thebes series consists of well drained and moderately well drained, moderately sloping to very steep soils on uplands. These soils are mostly in Corwin Township. They formed under mixed hardwoods in loess less than 40 inches thick and the underlying wind-deposited sand.

In a representative profile, the surface layer is dark grayish-brown silt loam about 5 inches thick. The subsoil is dark yellowish-brown silty clay loam in the upper 26 inches, and it is dark yellowish-brown loam or sandy loam in the lower 4 inches. Underlying the subsoil, to a depth of about 60 inches, is yellowish-brown fine sand.

Thebes soils are low in organic-matter content and moderate in natural fertility. They have moderate permeability and moderate available water capacity.

Most areas of Thebes soils are cultivated or in pasture. Some are in woodland. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of a severely eroded Thebes soil having slopes of 7 to 12 percent, in a pasture about 2.5 miles east of Middletown, 360 feet east and 339 feet south of the NW. corner of sec. 15, T. 19 N., R. 4 W.:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) heavy silt loam, brown (10YR 5/3) when dry; dark yellowish-brown (10YR 4/4) splotches; weak, very fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

B21t—5 to 12 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, continuous, dark-brown (10YR 4/3) clay films; moderate, very fine and fine, subangular blocky structure; firm; slightly acid; clear, smooth boundary.

B22t—12 to 20 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, continuous, dark-brown (10YR 4/3) clay films; moderate, medium, subangular blocky structure; firm; slightly acid; clear, smooth boundary.

B23t—20 to 31 inches, dark yellowish-brown (10YR 4/4) silty clay loam; thin, discontinuous, dark-brown (10YR 4/3) clay films; few black (5YR 2/1) iron and manganese stains; moderate, coarse, subangular blocky structure; firm; medium acid; clear, smooth boundary.

IIB3—31 to 35 inches, dark yellowish-brown (10YR 4/4) loam or sandy loam; few, patchy, dark-brown (10YR 3/3) clay films; weak, coarse, subangular blocky structure; friable; medium acid; abrupt, smooth boundary.

IIC—35 to 60 inches, yellowish-brown (10YR 5/4) fine sand; few loamy sand or light sandy loam bands ½ to 1 inch thick; single grain; loose; medium acid.

Color of the Ap horizon is dark grayish-brown (10YR 4/2) to dark brown (10YR 4/3). Texture ranges from silt loam to silty clay loam, and thickness ranges from 3 to 8 inches. In most places there is no A2 horizon. Where this horizon is present, it is brown (10YR 5/3) to yellowish brown (10YR 5/4) and ranges from 3 to 6 inches in thickness. Depth to loose sand ranges from 24 to 40 inches.

Thebes soils are on a landscape with Middletown, Alvin, and Lamont soils. Thebes soils are similar to Middletown soils in natural drainage but have loose sand closer to the surface. Thebes soils contain less sand in the surface layer and upper part of the subsoil than Alvin and Lamont soils.

Thebes silt loam, 3 to 7 percent slopes, eroded (212C2).—This soil is on short side slopes along drainageways and on small, narrow ridges. It has a profile similar to the one described as representative for the series, but the surface layer is thicker. The surface layer is about equal to the depth of plowing and includes some material from the upper part of the subsoil.

Included in mapping are small areas of severely eroded soils where the surface layer consists almost entirely of dark yellowish-brown subsoil material. Also included are small areas of soils where the subsoil is thicker than that in the soil having the representative profile. Areas less than one acre in size that have a sandy surface layer are shown on the soil map by a conventional symbol.

This soil is suited to crops commonly grown in the county but is not suited to intensive cultivation. Erosion is the major hazard, and droughtiness is a limitation in years when rainfall distribution is uneven. Erosion control measures, such as minimum tillage, help to reduce soil and water losses. Additions of organic matter help to improve tilth. Management group IIIe–3.

Thebes soils, 7 to 12 percent slopes, severely eroded (212D3).—This is the most extensive mapping unit in the Thebes series, and it has the profile described as representative for the series. These soils are on short slopes along drainageways or on long, narrow ridges. The present surface layer is a mixture of subsoil material and the original surface layer.

Included in mapping are small areas of slightly eroded soils and moderately eroded soils. These inclusions have a surface layer that contains less subsoil material. Also included are small areas of soils where the subsoil is thicker than that of the representative profile. Areas less than one acre in size that have a sandy surface are shown on the soil map by a conventional symbol.

These soils are suited to crops commonly grown in the county, but they are not suited to intensive cultivation. Erosion is a severe hazard. Low fertility and poor tilth are limitations. Droughtiness is a limitation in years when rainfall distribution is uneven. Erosion control measures, such as minimum tillage, help to reduce soil and water losses. Additions of organic matter help to improve tilth and increase fertility. Areas of these soils used for permanent pasture need to be seeded to adapted grasses and legumes and grazed under controlled conditions. Management group IVe–1.

Thebes silt loam, 12 to 35 percent slopes, eroded (212E2).—This soil occupies long, narrow ridges or short side slopes along drainageways. It has a somewhat thinner profile than the one described as representative for the series. In cultivated areas the thickness of the surface layer is about equal to the depth of plowing. Some material from the upper part of the subsoil is mixed with the surface layer.

Included in mapping are small areas of slightly eroded soils and severely eroded soils. Also included are small areas of soils where the subsoil is thicker than that of the soil having the representative profile. Areas less than one acre in size that have a sandy surface layer are shown by a conventional symbol on the soil map.

This soil is not as well suited to corn and soybeans as it is to small grains, grasses, legumes, or trees. It is not well suited to row crops, because of steep slopes. Erosion is a severe hazard. Droughtiness is a limitation when rainfall is low or unevenly distributed. Erosion control measures are needed to reduce soil losses. Additions of organic matter help to improve tilth and retain moisture. Management group VIe–1.

Tice Series

The Tice series consists of somewhat poorly drained, nearly level soils on bottom lands. These soils are mainly along Salt Creek. They formed in clayey water-laid sediments. The native vegetation was probably a mixture of prairie grasses and hardwood trees.

In a representative profile, the surface layer is very dark brown silty clay loam about 14 inches thick. The subsoil is dark grayish-brown silty clay loam mottled with strong brown and is about 21 inches thick. Underlying the subsoil, to a depth of 60 inches, is brown sandy loam mottled with strong brown.

Tice soils are high in organic-matter content and natural fertility. They have moderate permeability and high available water capacity.

Most areas of the Tice soils are cultivated. These soils are suited to corn, soybeans, oats, wheat, grasses, and legumes.

Representative profile of Tice silty clay loam, in a cultivated field about 4 miles east of Broadwell, 130 feet north and 70 feet east from bridge in the SE¼ sec. 25, T. 19 N., R. 3 W.:

Ap—0 to 8 inches, very dark brown (10YR 2/2) silty clay loam; moderate, fine and medium, granular structure; firm; neutral; abrupt, smooth boundary.

A1—8 to 14 inches, very dark brown (10 YR 2/2) silty clay loam; strong-brown (7.5YR 5/6) and yellowish-brown (10YR 5/8) flecks; moderate, medium, granular structure; firm; neutral; clear, smooth boundary.

B21—14 to 22 inches, very dark grayish-brown (10YR 3/2) light silty clay loam; strong-brown (7.5YR 5/6) flecks; weak, moderate, subangular blocky structure and moderate, fine, granular structure; firm; neutral; clear, smooth boundary.

B22—22 to 29 inches, dark grayish-brown (2.5Y 4/2) light silty clay loam; few, fine, prominent, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; friable; neutral; clear, smooth boundary.

B3—29 to 35 inches, dark grayish-brown (2.5Y 4/2) light silty clay loam; common, fine, faint, dark yellowish-brown (10YR 4/4) mottles and few, fine, prominent, strong-brown (7.5YR 5/6) mottles; weak, coarse, subangular blocky structure; friable; neutral; clear, smooth boundary.

C—35 to 60 inches, brown (10YR 5/3) light sandy loam; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; friable; neutral.

Color of the Ap and A1 horizons is very dark brown (10YR 2/2) to very dark grayish-brown (10YR 3/2). Texture of these horizons ranges from heavy silt loam to silty clay loam, and the combined thickness ranges from 12 to 18 inches. Texture of the B horizon is light silty clay loam to silty clay loam. Texture of the C horizon is silt loam to sandy loam.

Tice soils are on bottom lands with Sawmill, Lawson, Ross, and Huntsville soils. Tice soils have better natural drainage than Sawmill soils. They contain more clay than Lawson, Ross, and Huntsville soils.

Tice silty clay loam (284).—This is the only Tice soil mapped in the county. Slope is less than 2 percent except along some overflow channels where it exceeds 2 percent. Areas of this soil are irregular in shape. In many places they are intermingled with areas of other soils on bottom lands.

Included in mapping are small areas of soils that have better drainage than Tice soils. Also included are small areas of Sawmill and Huntsville soils. Areas less than one acre in size that have a sandy surface layer are shown on the soil map by a conventional symbol.

This soil is suited to crops commonly grown in the county. Overflow is a hazard, runoff is slow, and there are wet areas in some places. Clods form on the surface if the soil is tilled when it is too wet. If protected from overflow, adequately drained, and otherwise properly managed, this soil can be cropped intensively. Management group I–5.

Use and Management of the Soils

This section groups the soils into management groups and explains the capability classification used by the Soil Conservation Service to show the relative suitability of the soils for crops. A table giving the predicted yields under a high level of management is provided. Use of the soils as woodland, as wildlife habitat, and for recreation is discussed. Also included in this section are soil engineering data and interpretations.

About 80 percent of Logan County is cultivated. Corn and soybeans are the principal crops. Wheat, oats, and grass-legume hay are other important crops.

The main considerations in managing cultivated soils in the county are how to (1) reduce soil losses caused by soil blowing and water erosion, (2) protect the soils against flooding, (3) overcome wetness, (4) conserve moisture, and (5) maintain good tilth and fertility.

Measures that will help to control soil blowing and water erosion are terracing, contour farming, minimum tillage, cover crops, grassed waterways, and the use of crop residue. Generally, a combination of several measures is used.

Protection from flooding can be accomplished by construction of levees. Measures that help to overcome wetness include the use of tile drains, shallow surface ditches, inlets to tile drains, drainage ditches, and diversions.

Conserving moisture generally means reducing evaporation, limiting runoff, increasing infiltration, and controlling weeds. Practices that help to conserve moisture are minimum tillage, use of crop residue, contour farming, stripcropping, and field windbreaks.

Among the measures that help to maintain good tilth and fertility are the application of chemical fertilizer, green manure, and barnyard manure and the inclusion in the cropping system of cover crops, grasses, and legumes. Reducing soil losses caused by wind and water also helps to maintain fertility and tilth.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account possible major, and generally expensive, landforming that would change slope, depth, or other characteristics of the soils, or possible, but unlikely, major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees or for engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability *class*, *subclass*, and *unit* (management group in this soil survey). These are discussed in the following paragraphs.

Capability Classes, the broadest grouping, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

- Class I soils have few limitations that restrict their use.
- Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (None in Logan County.)
- Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.
- Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.
- Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife, or water supply, or to use for esthetic purposes. (None in Logan County.)

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in some parts of the United States but not in Logan County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Management Groups are soil groups within the subclasses. The soils in one group are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Management groups are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIw–1 or IIIe–1. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation, and the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph. The Arabic numeral specifically identifies the management group within each subclass.

The management classification of the soils in Logan County is given in the "Guide to Mapping Units" at the back of this survey.

Management groups

In the following pages the management groups in Logan County are described and suggestions for use and management of the soils in each group are given. Soils used for cultivated crops generally need lime and fertilizers. The amounts to apply on a given soil should be determined by soil tests. The names of soil series represented are mentioned in the description of each management group, but this does not mean that all soils of a given series appear in the group. To find the names of all the soils in any given management group, refer to the "Guide to Mapping Units" at the back of this survey.

MANAGEMENT GROUP I–1

This group consists of well drained and moderately well drained, nearly level soils of the Clinton and Fayette series. These soils are on uplands and terraces. Their surface layer is silt loam, and their subsoil is silty clay loam.

These soils are low in organic-matter content and moderate in natural fertility. They generally are low in content of nitrogen, low or medium in available phosphorus, and medium or high in available potassium. They have moderate or moderately slow permeability and high or very high available water capacity.

The soils of this group are well suited to the crops commonly grown in the county, such as corn, soybeans, wheat, oats, grasses, and legumes.

These soils have no major limitations to use. There is a tendency for crusts to form on the surface. The use of animal manures and crop residue will help maintain the organic-matter content and good tilth.

Row crops, such as corn and soybeans, can be grown several years in succession. The cropping system can also include small grains, grasses, and legumes. Crops respond well to fertilizers and lime.

MANAGEMENT GROUP I–2

This group consists of well drained and moderately well drained, nearly level soils of the Broadwell, Plano, Proctor, and Tama series. These soils are on uplands and terraces. They have a silt loam surface layer and are silty clay loam in the upper part of their subsoil.

These soils are high in organic-matter content and natural fertility. They generally are medium or high in content of nitrogen, low or medium in available phosphorus, and medium or high in available potassium. They are moderately permeable and have high or very high available water capacity.

The soils of this group are well suited to crops commonly grown in the county, such as corn, soybeans, wheat, oats, grasses, and legumes.

These soils have no major limitations to use. Row crops can be grown several years in succession. The cropping system can also include small grains, grasses, and legumes. Crops respond well to fertilizers and lime.

MANAGEMENT GROUP I-3

This group consists of well drained and moderately well drained, nearly level soils of the Huntsville and Ross series. These soils are on bottom lands. Huntsville soils are silt loam throughout, and Ross soils are loam throughout.

These soils are high in organic-matter content and natural fertility. They generally are high in content of nitrogen, and they are medium or high in available phosphorus and potassium. They have moderate permeability and high or very high available water capacity.

The soils of this group are well suited to the crops commonly grown in the county. Corn and soybeans are the main crops; a smaller acreage is used for wheat, oats, grasses, and legumes.

These soils are subject to overflow of short duration. Protection from overflow can be accomplished by use of levees where feasible.

Row crops can be grown several years in succession. Small grains, grasses, and legumes can also be included in the cropping system. Crops respond well to fertilizers.

MANAGEMENT GROUP I-4

This group consists of somewhat poorly drained, nearly level soils of the Brenton, Clarksdale, Elburn, Ipava, Lawndale, and Muscatine series. These soils are on uplands and terraces. The surface layer is silt loam, and the subsoil is silty clay loam.

These soils are moderate or high in organic-matter content and natural fertility. They generally are high in content of nitrogen, medium in available phosphorus, and medium or high in available potassium. They have moderate or moderately slow permeability and high or very high available water capacity.

The soils of this group are well suited to crops commonly grown in the county. Corn and soybeans are the main crops; other crops are wheat, oats, grasses, and legumes.

These soils have few limitations. Where wetness is a limitation, tile drains and shallow surface ditches can be used to improve drainage. Return of crop residue, use of animal manures, and plowed down grasses and legumes help to maintain good tilth and fertility.

Row crops can be grown several years in succession. The cropping system can also include small grains, grasses, and legumes. Crops respond well to fertilizers and lime.

MANAGEMENT GROUP I-5

This group consists of somewhat poorly drained, nearly level soils of the Lawson, Radford, and Tice series. These soils are on bottom lands. The upper 2 to 3 feet of the Lawson and Radford soils is silt loam. In the Tice soils, however, the upper 2 to 3 feet is silty clay loam.

These soils are high in organic-matter content and natural fertility. They generally are medium or high in content of nitrogen, available phosphorus, and available potassium. They have moderate permeability and high or very high available water capacity.

The soils of this group are suited to crops commonly grown in the county. Corn and soybeans are the main crops; other crops are wheat, oats, grasses, and legumes.

These soils are subject to overflow and a temporary seasonal high water table. Drainage can be improved by tile drains, but adequate outlets are commonly difficult to obtain, and underlying sand can be a problem when installing them. Open ditches can also be used to drain the soils, but maintaining such ditches is difficult where the soils are not protected from overflow. Where feasible, levees can be used to protect the soils from overflow. Diversions can be used to intercept runoff from nearby upland slopes.

Row crops, such as corn or soybeans, can be grown several years in succession. The cropping system can also include small grains, grasses, and legumes. Crops respond well to fertilizer.

MANAGEMENT GROUP IIe-1

This group consists of well drained and moderately well drained, gently sloping and moderately sloping soils of the Birkbeck, Clinton, Middletown, and St. Charles series. These soils are on uplands and terraces. The gently sloping soils are slightly eroded and the moderately sloping soils are eroded. The surface layer is silt loam, and the subsoil is silty clay loam.

These soils are low in organic-matter content and moderate in natural fertility. They generally are low in content of nitrogen and available phosphorus, and they are medium or high in available potassium. They have moderate or moderately slow permeability and high or very high available water capacity.

The soils of this group are suited to crops commonly grown in the county. Corn, soybeans, wheat, oats, grasses, and legumes are the main crops.

Erosion is the chief hazard to soils in this group. Poor tilth is a limitation, and crusts form easily on the surface. The eroded soils tend to have a cloddy surface layer if worked when too wet (fig. 13).

Management practices such as minimum tillage, terracing, contouring, and grassed waterways help to reduce soil losses (fig. 14). The proper use of crop residue and animal manures helps maintain organic matter, improve soil tilth, and reduce soil losses. If these practices are used, the cropping system can safely include more years of row crops and fewer years of grasses and legumes. Crops respond well to fertilizers and lime.

MANAGEMENT GROUP IIe-2

This group consists of well drained and moderately well drained, gently sloping and moderately sloping soils of the Broadwell, Catlin, Elkhart, Parr, Pillot, Plano, Proctor, and Tama series. These soils are on upland and terraces.

The gently sloping soils are uneroded or slightly eroded, and the sloping soils are eroded. The surface layer is silt loam; the upper part of the subsoil is silty clay loam, except in Parr soils where it is clay loam.

Figure 13.—**Eroded soils become cloddy if worked when the moisture content is too high. Soil is Birkbeck silt loam, 4 to 7 percent slopes, eroded.**

These soils are low to high in organic-matter content and moderate to high in natural fertility. They generally are medium or high in content of nitrogen, low or medium in available phosphorus, and medium or high in available potassium. They have high or very high available water capacity except for Pillot soils, which have moderate available water capacity. All the soils in this group have moderate permeability.

The soils of this group are suited to the crops commonly grown in the county. Corn and soybeans are the main crops; other crops are wheat, oats, grasses, and legumes.

Erosion is the main hazard to soils in this group. Animal manures and crop residue help to maintain the organic-matter content and good tilth. Management practices such as minimum tillage, terraces, grassed waterways, and contouring help to reduce soil losses (fig. 15). If these practices are used, the cropping system can safely include more years of row crops and fewer years of grasses and legumes. Crops respond well to fertilizers and lime.

MANAGEMENT GROUP IIw-1

This group consists of poorly drained and very poorly drained, nearly level soils of the Drummer, Harpster, Hartsburg, Sable, and Shiloh series. They are on uplands and terraces. These soils are silty clay loam throughout the surface layer except Shiloh soils. Shiloh soils have some silty clay in the surface layer.

Figure 14.—**Bench-type parallel terraces with back slope seeded to downy brome. Soil is a St. Charles silt loam.**

Figure 15.—**A Tama silt loam in corn planted on the contour.**

The soils in this group are high in organic-matter content, natural fertility, and content of nitrogen. Harpster soils are low in available phosphorus and potassium. The other soils generally are medium or high in available phosphorus and potassium. Permeability is moderate except in the Harpster and Shiloh soils. Harpster soils have moderately slow permeability, and Shiloh soils have slow or moderately slow permeability. Available water capacity is high or very high. Harpster soils are calcareous, and the other soils are slightly acid or neutral.

The soils of this group are suited to corn, soybeans, wheat, oats, grasses, and legumes.

Wetness is the main limitation, but ponding and a seasonal high water table are also limitations (fig. 16). If adequate outlets are available, tile drains function well in these soils with the exception of Shiloh soils. Shiloh soils can be drained by tile to surface inlets or by shallow surface ditches. All the soils compact and clod easily if tilled when too wet.

On much of their acreage, the soils in this group are plowed in fall and left bare during the winter so that freezing and thawing break up compaction and clods. Soil blowing, however, is a hazard during some years (fig. 17). Leaving alternate strips of unplowed soil or using winter cover crops will help to reduce soil blowing.

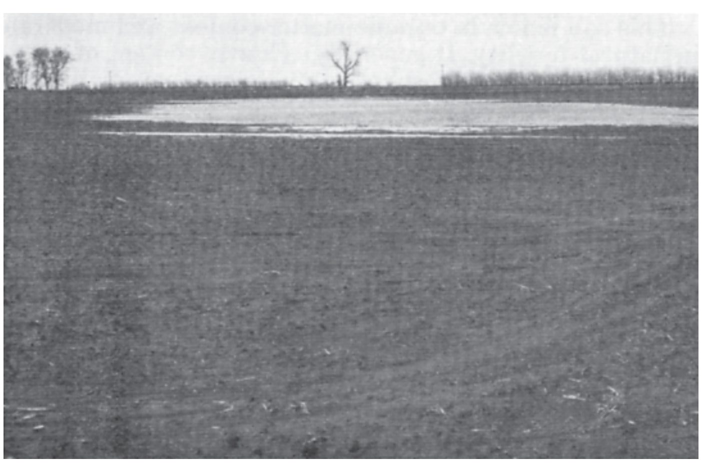

Figure 16.—**Ponding on Sable silty clay loam after a heavy rain.**

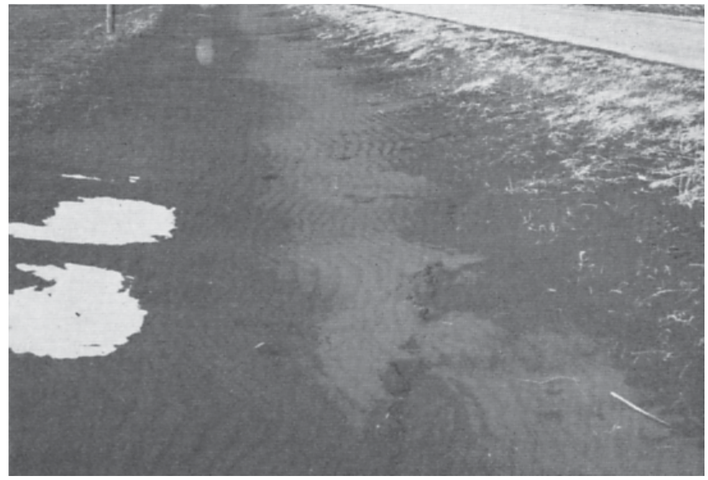

Figure 17.—**Roadside ditch completely filled with soil material blown from field of Hartsburg silty clay loam that was plowed in fall.**

Row crops can be grown several years in succession if these soils are adequately drained and good tilth is maintained. Crops respond well to fertilizers.

MANAGEMENT GROUP IIw–2

This group consists of poorly drained, nearly level soils of the Sawmill series. These soils are on bottom lands. They have a silty clay loam surface layer and subsoil, except for areas that have a silt loam overwash.

These soils are high in organic-matter content and natural fertility. They generally are high in nitrogen, available phosphorus, and available potassium. They have moderate to moderately slow permeability and very high available water capacity. They are neutral in reaction.

The soils of this group are suited to crops commonly grown in the county. Corn, soybeans, wheat, oats, grasses, and legumes are the main crops.

Major management requirements are protection from overflow (fig. 18), adequate drainage, and maintenance of good tilth. Where feasible, levees can be used to protect the soils from overflow. Drainage can be improved by tile drains or open ditches. Tile outlets are difficult to obtain and maintain in some places. If they are not protected from overflow, open ditches are difficult to maintain. Diversions can also be used to intercept runoff from nearby upland slopes. Maintaining good tilth is more difficult in Sawmill silty clay loam than it is in Sawmill silt loam, overwash. Management practices that return organic matter to the soil and reduce compaction help to maintain good tilth.

Row crops, such as corn or soybeans, can be grown several years in succession. Small grains and grasses and legumes can also be included in the cropping system.

MANAGEMENT GROUP IIw–3

This group consists of poorly drained to very poorly drained, nearly level soils of the Brooklyn, Denny, Knight, and Rushville series. These soils are on uplands and terraces. They have a silt loam surface layer and silty clay loam or silty clay subsoil.

The Brooklyn and Denny soils are moderate in organic-matter content. The Knight soils are high and the Rush-

Figure 18.—**Overflow on Sawmill silty clay loam along Lake Fork.**

ville soils are low in organic-matter content. All the soils have moderate natural fertility. They are medium or low in content or nitrogen, low in available phosphorus, and medium or high in available potassium. They have very slow to moderately slow permeability and high available water capacity.

The soils of this group are suited to the crops commonly grown in the county. Corn and soybeans are the main crops grown; other crops are wheat, oats, grasses, and legumes.

Major management requirements are adequate drainage and maintenance of fertility and good tilth. The Rushville soils, ordinarily in capability class III, are more difficult to drain and to manage than the other soils in this group. They are placed in this group because they are not extensive enough to warrant a separate discussion. All the soils have a seasonal high water table and are subject to ponding. Tile drains do not function well unless surface or blind inlets are used. Shallow surface ditches can be used to improve drainage where tiling is not practical. Animal manures and crop residue add organic matter and improve tilth.

Small areas of these soils are generally farmed with cropping systems that are suitable for the surrounding soils. Large areas of these soils can be used for row crops several years in succession if they are adequately drained and good tilth is maintained. Crops respond well to fertilizers and lime.

MANAGEMENT GROUP IIw-4

Keomah silt loam is the only soil in this group. It is somewhat poorly drained and nearly level. This soil is on uplands and terraces. The surface layer is silt loam, and the subsoil is silty clay loam.

This soil is low in organic-matter content and moderate in natural fertility. It generally is low in content of nitrogen and available phosphorus and is medium or high in available potassium. It has moderately slow permeability and high or very high available water capacity.

This soil is suited to the crops commonly grown in the county. Corn and soybeans are the main crops grown; other crops are wheat, oats, grasses, and legumes.

Wetness is the main limitation of this soil. The main management requirements are adequate drainage and maintenance of fertility and good tilth. Tile drains can be used to improve drainage if adequate outlets are available. In places, tile inlets or shallow surface ditches can be used. Animal manures and crop residue add organic matter and help to improve tilth.

Row crops can be grown several years in succession. The cropping system can also include small grains, grasses, and legumes. Crops respond well to fertilizers and lime.

MANAGEMENT GROUP IIs–1

In this group are moderately well drained to somewhat excessively drained, nearly level soils of the Dickinson and Onarga series. These soils are on uplands and terraces. Dickinson soils are sandy loam throughout. Onarga soils have a surface layer of sandy loam and a subsoil of sandy clay loam.

The soils in this group are moderate in organic-matter content and natural fertility. They generally are medium in content of nitrogen and low or medium in available phosphorus and potassium. Dickinson soils have moderately rapid to rapid permeability, and Onarga soils have moderate or moderately rapid permeability. Dickinson soils have low available water capacity, and Onarga soils have moderate available water capacity.

The soils of this group are suited to crops commonly grown in the county. Corn and soybeans are the main crops; other crops are wheat, oats, grasses, and legumes.

Careful management is needed to conserve moisture, help control soil blowing, and maintain fertility. Because of their sandy nature, these soils are unable to hold large amounts of plant nutrients. To reduce losses by leaching, fertilizer should be applied often and in small amounts. Returning crop residue and applying animal manure add organic matter that helps conserve moisture. Crop residue on the surface or a winter cover crop helps to provide protection from soil blowing.

Areas of these soils are small. They are generally farmed with cropping systems that are suitable to the surrounding silty soils. Crops respond well to fertilizers and lime.

MANAGEMENT GROUP IIIe–1

This group consists of well drained and moderately well drained, strongly sloping soils of the Birkbeck, Clinton, Miami, and Middletown series. These soils are on uplands and terraces. They are moderately eroded. The surface layer is silt loam. The subsoil is silty clay loam, except in the Miami soils where it is clay loam.

The soils of this group are low in organic-matter content and moderate in natural fertility. They generally are low in content of nitrogen and available phosphorus and medium or high in available potassium. They have moderate or moderately slow permeability and high available water capacity.

The soils of this group are suited to crops commonly grown in the county. They are used for corn, soybeans, wheat, oats, grasses, and legumes. These soils are also suited to permanent pasture and woodland.

These soils are subject to severe erosion if cultivated. Because the organic-matter content is low, crusts and clods form readily on the surface. Terracing, contouring, grassed waterways, minimum tillage, and the proper use of crop residues help to maintain the organic-matter content, improve tilth, and control erosion. If these practices are used, the cropping system can safely include more years of row crops and fewer years of grasses and legumes. Crops respond well to fertilizers and lime.

MANAGEMENT GROUP IIIe–2

This group consists of well drained and moderately well drained, strongly sloping soils of the Bold, Broadwell, Catlin, Elkhart, Parr, Proctor, Tama, and Tallula series. These soils are mainly on uplands, but a few areas are on terraces. The soils are eroded. They have a silt loam surface layer and generally are silty clay loam in the upper part of the subsoil. In the Parr soils, however, the upper part of the subsoil is clay loam, and in the Tallula and Bold soils it is silt loam.

The soils of this group are low to high in organic-matter content and are moderate to high in natural fertility, except for the Bold soils, which have a low organic-matter content and low natural fertility. The soils of this group generally are medium or high in content of nitrogen, low or medium in available phosphorus, and medium or high in available potassium. They have moderate permeability and high or very high available water capacity.

These soils are suited to crops commonly grown in the county. They are used for corn, soybeans, wheat, oats, grasses, and legumes. They are also suited to permanent pasture.

These soils are subject to severe erosion if they are cultivated. Adding animal manures and crop residue helps to maintain the organic-matter content and good tilth. These practices and terracing (fig. 19), contouring, grassed waterways (fig. 20), and minimum tillage help to control erosion. If these practices are used, the cropping system can safely include more years of row crops and fewer years of grasses and legumes.

MANAGEMENT GROUP IIIe–3

This group consists of somewhat excessively drained to moderately well drained, gently sloping to strongly sloping soils of the Alvin, Dickinson, Lamont, Onarga, Pillot, and Thebes series. These soils are on uplands and terraces. Generally, the soils in this group are eroded, but some of the Dickinson-Onarga sandy loams are uneroded. Alvin, Dickinson, Lamont, and Onarga soils have a surface layer of sandy loam and a subsoil of clay loam to sandy loam. Pillot and Thebes soils have a surface layer of silt loam. The upper part of their subsoil is silty clay loam, and the lower part is sandy clay loam to sandy loam.

Alvin, Lamont, and Thebes soils are low in organic-matter content. The other soils are moderate or high in organic-matter content. Natural fertility is low in the Alvin and Lamont soils, and it is moderate or high in the Dickinson, Onarga, Pillot, and Thebes soils. Soils of this

Figure 19.—**Parallel tile outlet (level ridge) terraces on a Tama silt loam. Inlet pipe is in right center of picture.**

Figure 20.—Grassed waterway with strongly sloping Catlin silt loam on the side slopes.

group are low to medium in content of nitrogen and available phosphorus and medium or high in available potassium. Permeability is moderate to rapid. The Lamont and Dickinson soils have low available water capacity, and the Alvin, Onarga, Pillot, and Thebes soils have moderate available water capacity.

The soils of this group are suited to crops commonly grown in the county. They are used for corn, soybeans, wheat, oats, grasses, and legumes. These soils are also suited to permanent pasture and woodland.

Careful management is needed to conserve moisture, control water erosion and soil blowing, and maintain fertility. Fertilizer should be applied to the sandier soils often and in small amounts to reduce losses by leaching. Practices such as terracing, contouring, grassed waterways, minimum tillage, and proper use of crop residue will reduce soil and water losses and help to maintain fertility. More years of row crops and fewer years of grasses and legumes can be included in the cropping system if these measures are taken. Where erosion control practices are not adaptable, maximum use of close-growing crops and limited use of row crops are needed to control erosion. Crops respond well to fertilizers and lime.

MANAGEMENT GROUP IVe–1

This group consists of well drained and moderately well drained, strongly sloping and moderately steep soils of the Birkbeck, Clinton, Miami, Russell, and Thebes series. These soils are on the uplands, and they are eroded and severely eroded. The surface layer is generally silt loam, but in the severely eroded soils it is silty clay loam or clay loam. The upper part of the subsoil is silty clay loam except in the Miami soils, where it is clay loam.

These soils are low in organic-matter content and moderate in natural fertility. They generally are low in content of nitrogen and available phosphorus and are medium or high in available potassium. They have moderate or moderatively slow permeability. All have high available water capacity except the Thebes soils, which have a moderate available water capacity.

The soils of this group are suited to small grains, grasses, and legumes. These soils are also suited to permanent pasture and woodland. They are not suited to intensive use for row crops such as corn and soybeans.

On these soils there is a severe hazard of erosion; careful management is needed to control erosion and maintain fertility and good tilth. Even with conservation practices such as terracing, contouring, and grassed waterways, these soils need more grasses and legumes than row crops, such as corn and soybeans, in the cropping system. Minimum tillage and conservation of crop residue will help maintain good tilth and fertility. Grazing and weeds need to be controlled in permanent pastures. Crops respond well to fertilizers and lime.

MANAGEMENT GROUP VIe–1

This group consists of well drained and moderately well drained, moderately steep and steep soils of the Alvin, Lamont, and Thebes series. These soils are on uplands and are slightly eroded and eroded. Alvin and Lamont soils have a surface layer of sandy loam and a subsoil of sandy loam to clay loam. Thebes soils have a silt loam surface layer; the upper part of their subsoil is silty clay loam, and the lower part is sandy clay loam to sandy loam.

The soils in this group are low in organic-matter content and low or moderate in natural fertility. They are low or medium in content of nitrogen and available phosphorus, and they are medium or high in available potassium. Lamont soils have a low available water capacity. Alvin and Thebes soils have a moderate available water capacity. Alvin and Lamont soils have moderate or moderately rapid permeability, and Thebes soils have moderate permeability.

The soils of this group are suited to permanent vegetation, such as hay, pasture, or woodland. Soils having slopes too steep to permit safe use of machinery in pasture management are used for woodland.

The main management requirements on these soils are the reduction of soil losses caused by erosion and the maintenance of fertility. Areas suitable for hay or pasture need to be limed and fertilized regularly and seeded to adapted grass-legume mixtures. Controlled grazing and weed and brush control are needed to maintain vegetation and help to prevent erosion. Wooded areas of these soils can be managed for wood products if existing trees are of good quality. Dead, diseased, and undesirable species of trees need to be removed. Protection from fire and grazing is also needed. Adapted pines do well on these soils.

MANAGEMENT GROUP VIIe-1

This group consists of well drained and moderately well drained, steep and very steep soils of the Hennepin, Hickory, Miami, and Sylvan series. These soils are on uplands. They are slightly eroded and eroded. Hennepin and Hickory soils have a loam surface layer. Miami and Sylvan soils have a silt loam surface layer. In Hennepin soils the subsoil is loam, in Hickory and Miami soils it is clay loam, and in Sylvan soils it is silty clay loam.

The soils of this group are low in organic-matter content and moderate in natural fertility. They generally are low in content of nitrogen and available phosphorus and are medium or high in available potassium. They have moderate permeability and moderate or high available water capacity.

The soils of this group are suited to permanent pasture or woodland. They are too steep for machinery; their use for crops is severely limited. Some areas of these soils are used for woodland, and others are used for pasture.

In much of the existing woodland the stands are of low quality. Where the stands are of good quality, dead, diseased, and undesirable species of trees should be removed and protection from fire and grazing is needed. Adapted pines do well on these soils. Most pasture areas are in bluegrass. Steepness of slope limits many practices, such as seeding adapted grass and legume mixtures and applying lime and fertilizer. Controlled grazing and weed and brush control help to improve these pasture areas.

Predicted Yields

Table 5 shows predicted yields of the principal crops grown in Logan County under a high level of management. These predictions are based on yields for the period 1954–63, on soil tests, and on the experience and records of farmers, agronomists, conservationists, and farm advisors (*11*). The predictions are adjusted to reflect the trend toward higher yields during the period 1963 to 1968. Average yields are expected to increase. A few farmers obtain yields as high as 200 bushels of corn an acre in some years, but yields this high are still uncommon.

Management was determined on the basis of farming techniques, crop varieties, and fertilizers commonly used in 1968. Differences in weather from year to year may cause annual yields to range 20 percent above or below those shown in the table. Hay and pasture yields are estimated for varieties of grasses and legumes adapted to the soil.

Under high-level management, adequate drainage, flood control, and erosion control are provided; the proper number of plants is grown; high-quality seed is used; tillage is kept to a minimum and is done when soil moisture is favorable; weeds, plant diseases, and harmful insects are controlled; favorable soil reaction and near optimum levels of nitrogen, phosphorus, and potassium are maintained; available crop residue, barnyard manure, and green-manure crops are used efficiently; crops are harvested with the smallest possible loss; the combination of practices used is efficient; and all operations are timely.

Woodland [3]

Only a small percentage of Logan County was woodland when settlers first came to the county. At that time trees occupied the Clinton-Keomah, Clinton-Birkbeck-Miami, and Middletown-Alvin-Lamont soil associations. The Sawmill-Lawson association also had a considerable number of wooded areas. These soil associations are shown on the general soil map at the back of this survey.

Generally, the soils well suited to timber are also well suited to farming. Clearing of the land for farming removed the timber from most of the best sites. The present woodland is mainly on the steeper slopes and narrow ridgetops. According to the Illinois Soil and Water Conservation Needs Inventory published in 1970, Logan County has 9,400 acres of woodland. This is approximately 2.3 percent of the total land area. Indiscriminate harvesting practices, fire, and grazing have left much of the woodland understocked and containing trees of low quality.

Most of the woodland is on soils of the Alvin, Lamont, Birkbeck, Clinton, Hennepin, Miami, Hickory, Sylvan, and Thebes series. Upland oaks are the dominant species.

Generally, woodland soils can be placed in three broad productivity groups based upon the estimated growth of upland oaks measured by the Doyle Rule (*6*). On the Birkbeck, Clinton, Hennepin, and Hickory soils, the site index is 85 or more. Well-stocked, managed stands are capable of producing 350 to 450 board feet per acre annually. On the Alvin, Thebes, Miami, and Sylvan soils, the site index is 75 to 85, and well-stocked, managed stands are capable of producing 250 to 350 board feet per acre annually. Upland oaks on Lamont soils have a site index of 65 to 75, and well-stocked, managed stands are capable of producing 150 to 250 board feet per acre annually.

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[3] WILLIAM CLARK, woodland conservationist, Soil Conservation Service, assisted in preparing this subsection.

TABLE 5.—*Predicted average acre yields of principal crops*

[Yields are those to be expected under a high level of management. Absence of a yield figure indicates that the crop is not well suited to the soil or that the crop is not commonly grown]

Soil	Corn	Soybeans	Wheat	Oats	Grass legume hay [1]	Rotation pasture
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [2]
Alvin-Lamont sandy loams, 2 to 6 percent slopes, eroded	70	25	35	50	3.0	150
Alvin-Lamont sandy loams, 7 to 12 percent slopes, eroded	65	22	30	45	2.8	140
Alvin-Lamont sandy loams, 12 to 30 percent slopes			25	40	2.4	120
Birkbeck silt loam, 2 to 4 percent slopes	110	38	48	65	5.0	250
Birkbeck silt loam, 4 to 7 percent slopes, eroded	100	35	42	60	4.5	225
Birkbeck-Miami silt loams, 7 to 12 percent slopes, eroded	95	32	40	55	4.2	210
Birkbeck-Miami complex, 7 to 12 percent slopes, severely eroded	90	28	38	50	4.0	200
Brenton silt loam	140	48	58	85	5.8	290
Broadwell silt loam, 0 to 2 percent slopes	130	45	55	75	5.2	260
Broadwell silt loam, 2 to 4 percent slopes	125	42	52	75	5.0	250
Broadwell silt loam, 4 to 7 percent slopes, eroded	115	40	50	70	4.8	240
Broadwell silt loam, 7 to 12 percent slopes, eroded	100	35	45	65	4.5	235
Brooklyn silt loam	100	35	40	55	3.5	175
Catlin silt loam, 2 to 4 percent slopes	130	45	55	80	5.5	275
Catlin silt loam, 4 to 7 percent slopes, eroded	115	40	50	70	5.0	250
Catlin silt loam, 7 to 12 percent slopes, eroded	110	38	48	70	4.8	240
Clarksdale silt loam	120	42	52	70	5.0	250
Clinton silt loam, 0 to 2 percent slopes	110	38	48	65	5.0	250
Clinton silt loam, 2 to 4 percent slopes	110	38	48	65	5.0	250
Clinton silt loam, 4 to 7 percent slopes, eroded	100	35	42	60	4.5	225
Clinton silt loam, 7 to 12 percent slopes, eroded	95	32	40	55	4.2	210
Clinton soils, 7 to 12 percent slopes, severely eroded	90	28	38	50	4.0	200
Clinton silt loam, 12 to 18 percent slopes, eroded	90		38	50	4.0	200
Denny silt loam	105	38	40	65	3.8	190
Dickinson-Onarga sandy loams, 0 to 2 percent slopes	80	28	40	60	3.2	160
Dickinson-Onarga sandy loams, 2 to 7 percent slopes	75	28	35	55	3.0	150
Dickinson-Onarga sandy loams, 2 to 7 percent slopes, eroded	70	25	35	55	2.8	140
Dickinson-Onarga sandy loams, 7 to 15 percent slopes, eroded	65	20	32	50	2.5	135
Drummer silty clay loam	130	45	55	75	5.2	260
Elburn silt loam	140	48	58	85	5.8	290
Elkhart silt loam, 4 to 7 percent slopes, eroded	110	38	48	65	4.8	240
Elkhart silt loam, 7 to 12 percent slopes, eroded	100	35	45	60	4.5	225
Fayette silt loam	120	42	52	70	5.2	260
Harpster silty clay loam	120	42	50	70	4.5	225
Hartsburg silty clay loam	130	45	50	80	5.0	250
Hennepin and Miami soils, 18 to 60 percent slopes					2.5	140
Hickory and Sylvan soils, 15 to 50 percent slopes, eroded					3.5	175
Huntsville silt loam	130	45	55	80	5.5	275
Ipava silt loam	140	48	58	80	5.8	290
Keomah silt loam	110	38	48	65	5.0	250
Knight silt loam	105	38	40	65	3.8	190
Lawndale silt loam	135	45	55	80	5.5	275
Lawson silt loam	130	45	55	80	5.5	275
Miami-Russell silt loams, 12 to 18 percent slopes, eroded	80	25	35	50	3.5	175
Middletown silt loam, 1 to 4 percent slopes	110	38	48	65	5.0	250
Middletown silt loam, 4 to 7 percent slopes, eroded	100	35	42	60	4.5	225
Middletown silt loam, 7 to 15 percent slopes, eroded	95	32	40	55	4.2	210
Muscatine silt loam	140	48	58	85	5.8	290
Parr silt loam, 4 to 7 percent slopes, eroded	105	35	45	65	4.5	225
Parr silt loam, 7 to 18 percent slopes, eroded	100	35	42	60	4.2	210
Pillot silt loam, 1 to 4 percent slopes	90	32	42	60	3.8	190
Pillot silt loam, 4 to 10 percent slopes, eroded	80	28	38	55	3.5	175
Plano silt loam, 0 to 2 percent slopes	135	48	55	80	5.5	275
Plano silt loam, 2 to 4 percent slopes	135	48	55	80	5.5	275
Plano silt loam, 4 to 7 percent slopes, eroded	120	40	52	70	5.0	250
Proctor silt loam, 0 to 2 percent slopes	125	45	55	75	5.2	260
Proctor silt loam, 2 to 4 percent slopes	125	45	55	75	5.2	260
Proctor silt loam, 4 to 7 percent slopes, eroded	115	40	50	70	4.8	240
Proctor silt loam, 7 to 12 percent slopes, eroded	95	38	48	65	4.5	225
Radford silt loam	120	42	50	70	5.2	260
Ross loam	130	45	55	80	5.5	275
Rushville silt loam	100	35	42	60	3.8	190
Sable silty clay loam	130	45	55	80	5.2	260
St. Charles silt loam, 1 to 4 percent slopes	115	40	50	70	4.8	240
St. Charles silt loam, 4 to 7 percent slopes, eroded	105	35	45	65	4.5	225
Sawmill silty clay loam	120	42	50	70	4.8	240

See footnotes at end of table.

TABLE 5.—*Predicted average acre yields of principal crops*—Continued

Soil	Corn	Soybeans	Wheat	Oats	Grass legume hay [1]	Rotation pasture
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [2]
Sawmill silt loam, overwash	120	42	50	70	4.8	240
Shiloh silty clay loam	115	40	50	65	4.5	225
Tallula-Bold silt loams, 6 to 15 percent slopes, eroded	100	35	45	60	4.5	225
Tama silt loam, 0 to 2 percent slopes	135	48	55	80	5.5	275
Tama silt loam, 2 to 4 percent slopes	135	48	55	80	5.5	275
Tama silt loam, 4 to 7 percent slopes, eroded	120	42	52	70	5.0	250
Tama silt loam, 7 to 12 percent slopes, eroded	115	40	50	70	4.8	240
Thebes silt loam, 3 to 7 percent slopes, eroded	80	28	40	55	3.5	170
Thebes soils, 7 to 12 percent slopes, severely eroded	65	25	30	45	2.8	135
Thebes silt loam, 12 to 35 percent slopes, eroded	----------	----------	30	45	2.8	135
Tice silty clay loam	130	45	55	80	5.0	250

[1] Hay and pasture yields are predicted for mixed stands of grasses and legumes that are adapted to the soil.

[2] Animal-unit-days is a term used to express the carrying capacity of pasture. It is the number of days 1 acre can carry 1 animal unit during a single grazing season without injury to the sod. One animal unit is defined as 1 cow, 2 yearling calves, 1 horse, 5 sheep, or 4 brood sows. For example, 20 sheep can graze about 25 days in a pasture that has a capacity of 100 animal-unit-days.

Wildlife

The principal species of wildlife in Logan County is the ring-necked pheasant. Other wildlife species are cottontail rabbit, squirrel, bobwhite quail, mourning dove, red fox, white-tailed deer, raccoon, opossum, skunk, muskrat, some beaver, some migratory waterfowl, and nongame birds.

Ring-necked pheasants are throughout the county except in some of the more sloping areas of the Clinton-Birkbeck-Miami soil association and the Middletown-Alvin-Lamont soil association.

Cottontail rabbits and other game are more common on the Sawmill-Lawson, Clinton-Keomah, Clinton-Birkbeck-Miami, and Middletown-Alvin-Lamont soil associations than on the other soil associations. These associations have more trees, brushy areas, and fence rows that provide more cover than the other associations. White-tailed deer are not common, but a few live in wooded areas close to the major streams.

Streams and ponds provide water for wildlife. Streams are in the Sawmill-Lawson association, and ponds are more abundant in the Clinton-Keomah and Clinton-Birkbeck-Miami associations than in the other associations. These streams and ponds are the major fishing waters in the county. Smallmouth bass, sunfish, croppies, bullheads, channel catfish, suckers, and carp are the main game fish in Deer Creek, Kickapoo Creek, Lake Fork, Salt Creek, and Sugar Creek. Most ponds are stocked with largemouth bass and bluegills.

Recreational Uses of the Soils

In table 6 the soils of Logan County are placed in groups and are rated according to their limitations for recreational uses. The soil ratings for each group are based on soil characteristics that affect use, such as natural drainage, seasonal high water table, flooding hazard, permeability, slope, texture of the surface layer, and stoniness or rockiness.

The ratings are *slight*, *moderate*, or *severe*. A rating of *slight* means that the soil has few or no limitations for the use specified in the table or that the limitations can be easily overcome. A rating of *moderate* indicates that the limitations can be overcome by careful planning and maintenance. A rating of *severe* indicates that the soil is poorly suited to the use specified or that the limitations can be overcome only by intensive, costly engineering practices. The soil properties that determine moderate and severe limitations are described with the ratings in table 6. The recreational uses given in the table are discussed in the following paragraphs.

Cottages and utility buildings.—These include cottages, washrooms and bathrooms, picnic shelters, and service buildings that are used seasonally or all year. The ratings are based mainly on soil features that contribute to the adequate support of these structures. Information on soil limitations for septic tank filter fields is given in the section "Engineering Uses of the Soils."

Campsites.—These are areas suitable for tents and trailers and for living outdoors for a period of 1 week or longer. Little site preparation should be required. The soils are rated according to their limitations for unsurfaced parking areas for cars and camp trailers, and for heavy traffic by people, horses, and small vehicles such as bicycles.

Picnic areas.—Soils used for picnic areas need to support intensive foot traffic. Features that affect the desirability of a site, such as trees or ponds, are not considered in the ratings.

Playgrounds.—These areas are developed for intensive play and for organized games such as baseball, football, and tennis. They are subject to intensive foot traffic.

Paths and trails.—Soils used for paths and trails need to support intensive traffic of people on foot or on horseback. Little preparation is required. Paths and trails on sloping soils should be contoured to control erosion.

Golf fairways.—The soils are rated according to their limitations for fairways only. Greens, traps, and hazards generally are made from transported soil material. Soils used for fairways should support intensive traffic of people on foot or driving golf carts. Turf and various kinds of trees and shrubs grow well on these soils.

Engineering Uses of the Soils [4]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of engineering projects. Among the properties most important to engineers are permeability to water, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, plasticity, and compaction. Also important are depth to water table, hazard of flooding, depth to bedrock, and relief. Such information is made available in this subsection. Engineers can use it to—

1. Make studies that will aid in planning and developing agricultural, industrial, business, residential, and recreational sites.
2. Make preliminary evaluations of the soils that will aid in selecting locations for flood-control structures, agricultural drainage systems, farm ponds, irrigation systems, diversion terraces, and waterways.
3. Make preliminary evaluation of soils and sites that will aid in selecting locations for highways and airports and in planning detailed investigations at the selected locations.
4. Locate probable sources of road and highway construction materials.
5. Correlate performance of engineering structures with soil mapping units to obtain information that will be useful in designing and maintaining such structures.

[4] EARL E. EVANS, area engineer, Soil Conservation Service, helped prepare this subsection.

TABLE 6.—*Recreational*

Recreational group, soil series, and map symbols	Degree of limitation and soil features affecting use for—	
	Cottages and utility buildings	Campsites
Group 1. Poorly drained and very poorly drained, nearly level soils on uplands and terraces. Brooklyn (136), Denny (45), Drummer (152), Harpster (67), Hartsburg (244), Knight (191), Rushville (16), Sable (68), Sawmill (107, 107+), Shiloh (138).	Severe: seasonal high water table near surface; subject to ponding; soils dry slowly; some soils are difficult to drain; subject to frost heave and shrink swell. Sawmill soils are subject to flooding.	Severe: seasonal high water table near surface; subject to ponding; soils dry slowly; some soils are difficult to drain; bare soils arè slippery and sticky when wet. Sawmill soils are subject to flooding.
Group 2. Somewhat poorly drained, nearly level soils on uplands and terraces. Brenton (149), Clarksdale (257), Elburn (198), Ipava (43), Keomah (17), Lawndale (683), Muscatine (41).	Moderate: seasonal high water table near surface; subject to frost heave.	Moderate: seasonal high water table near surface.
Group 3. Well drained and moderately well drained, nearly level to moderately sloping soils on uplands and terraces. Alvin-Lamont (975C2), Birkbeck (233B, 233C2), Broadwell (684A, 684B, 684C2), Catlin (171B, 171C2), Clinton (18A, 18B, 18C2), Dickinson-Onarga (974A, 974B, 974C2), Elkhart (567C2), Fayette (280), Middletown (685B, 685C2), Parr (221C2), Pillot (159B, 159C2), Plano (199A, 199B, 199C2), Proctor (148A, 148B, 148C2), St. Charles (243B, 243C2) Tama (36A, 36B, 36C2), Thebes (212C2).	Slight	Slight
Group 4. Well drained and moderately well drained, strongly sloping soils on uplands and terraces. Alvin-Lamont (975D2), Birkbeck-Miami, (968D2, 968D3), Broadwell (684D2), Catlin (171D2), Clinton (18D2, 18D3), Dickinson-Onarga (974D2), Elkhart (567D2), Middletown (685D2), Parr (221D2), Proctor (148D2), Tallula-Bold (965D2), Tama (36D2), Thebes (212D3).	Moderate: slope	Moderate: slope; bare soil is slippery and sticky when wet for 18D3, 212D3, and 968D3.
Group 5. Well drained to somewhat poorly drained, moderately permeable, nearly level, silty and clayey bottom land soils. Huntsville (77), Lawson (451), Radford (74), Ross (73), Tice (284).	Severe: all soils subject to flooding; seasonal high water table near surface in Lawson, Radford, and Tice soils.	Severe: all soils subject to flooding; seasonal high water table near surface in Lawson, Radford, and Tice soils.
Group 6. Well drained and moderately well drained, moderately steep to very steep soils on uplands. Alvin-Lamont (975E), Clinton (18E2), Hennepin and Miami (964F), Hickory and Sylvan (963F2), Miami-Russell (966E2), Thebes (212E2).	Severe: slope	Severe: slope

6. Determine the suitability of soil units for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps, reports, and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
8. Make preliminary estimates for other construction purposes pertinent to the particular area.

It should be emphasized that the interpretations made in this soil survey are not a substitute for the sampling and testing needed at a site chosen for a specific engineering work that involves heavy loads or at a site where excavations are to be deeper than the depths of the layers here reported. Engineers should not apply specific values to the bearing capacity estimates given in this survey. Nevertheless, by using this survey, an engineer can select and concentrate on those soil units most important for his proposed construction, and in this manner reduce the number of soil samples taken for laboratory testing and, thus, complete an adequate soil investigation at minimum cost.

Valuable information in planning engineering work is given throughout the text, particularly in the sections "Descriptions of the Soils" and "Formation, Morphology, and Classification of Soils."

Some of the terms used by the scientist may be unfamiliar to the engineer, and some words—for example, soil, clay, silt, and sand—have special meaning in soil science. These and other special terms used in the soil survey are defined in the Glossary at the end of this survey. Most of the engineering information in this subsection is given in tables 7 and 8.

interpretations of the soils

Degree of limitation and soil features affecting use for—Continued			
Picnic areas	Playgrounds	Paths and trails	Golf fairways
Severe: seasonal high water table near surface; subject to ponding; soils dry slowly; some soils are difficult to drain; bare soils are slippery and sticky when wet. Sawmill soils are subject to flooding.	Severe: seasonal high water table near surface; subject to ponding; soils dry slowly; some soils are difficult to drain; turf damaged easily where wet. Sawmill soils are subject to flooding.	Severe: seasonal high water table near surface; subject to ponding; soils dry slowly; bare soils are slippery and sticky when wet. Sawmill soils are subject to flooding.	Severe: seasonal high water table near surface; subject to ponding; soils dry slowly; some soils are difficult to drain; moderate natural fertility; turf damaged easily when wet. Sawmill soils are subject to flooding.
Moderate: seasonal high water table near surface.	Moderate: seasonal high water table near surface.	Moderate: seasonal high water table near surface.	Moderate: seasonal high water table near surface.
Slight: Alvin-Lamont and Dickinson-Onarga sandy loams are droughty.	Slight on 0 to 2 percent slopes. Moderate on 2 to 7 percent slopes. Alvin-Lamont and Dickinson-Onarga sandy loams are droughty.	Slight	Slight: some difficulty in maintaining good turf on Alvin-Lamont and Dickinson-Onarga sandy loams because of droughtiness.
Moderate: slope; bare soil is slippery and sticky when wet for 18D3, 212D3, and 968D3. 974D2 and 975D2 are droughty.	Severe: slope. 974D2 and 975D2 are droughty.	Moderate: slope; bare soil is slippery and sticky when wet for 18D3, 212D3, and 968D3.	Moderate: slope; difficult to maintain good turf on 18D3 and 968D3 because of severely eroded condition and on 974D2 and 975D2 because of droughtiness.
Moderate: all soils subject to flooding; seasonal high water table near surface in Lawson, Radford, and Tice soils.	Severe: all soils subject to flooding; seasonal high water table near surface in Lawson, Radford, and Tice soils.	Moderate: all soils subject to flooding; seasonal high water table near surface in Lawson, Radford, and Tice soils.	Moderate: all soils subject to flooding; seasonal high water table near surface in Lawson, Radford, and Tice soils.
Severe: slope	Severe: slope	Moderate for 18E2, 212E2, 966E2, and 975E: slope. Severe for 963F2 and 964F. Slope limits use for all soils.	Severe: slope.

TABLE 7.—*Estimated*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in for referring to other series that appear in the first

Soil series and map symbols	Depth to seasonal high water	Depth from surface [1]	Classification: USDA texture	Unified	AASHO
	Feet	*Inches*			
*Alvin: 975C2, 975D2, 975E. For properties of Lamont soils in mapping units 975C2, 975D2, and 975E, see Lamont series.	5–10	0–9	Sandy loam	SM or ML	A–2 or A–4
		9–34	Sandy clay loam and clay loam	SC, CL, or SM	A–2, A–4, or A–6
		34–60	Sand	SP or SM	A–2 or A–3
*Birkbeck: 233B, 233C2, 968D2, 968D3. For properties of Miami soils in mapping units 968D2 and 968D3, see Miami series.	5–10	0–6	Silt loam	ML or CL	A–4 or A–6
		6–51	Silty clay loam and silt loam	CL	A–7 or A–6
		51–60	Loam	ML or CL	A–4 or A–6
Bold. Mapped only in a complex with Tallula soils.	5–10	0–60	Silt loam	ML	A–4
Brenton: 149	0–3	0–14	Silt loam	ML, CL, or OL	A–4 or A–6
		14–42	Silty clay loam and clay loam	CL	A–6 or A–7
		42–60	Stratified loam, sandy loam, and sand.	SC, SM, or CL	A–4, A–6, or A–2
Broadwell: 684A, 684B, 684C2, 684D2	5–10	0–15	Silt loam	CL or ML	A–7 or A–6
		15–48	Silty clay loam	CL	A–7 or A–6
		48–60	Loamy sand or sand	SP or SM	A–3 or A–2
Brooklyn: 136	0–3	0–16	Silt loam	CL	A–6 or A–7
		16–51	Silty clay loam	CL or CH	A–6 or A–7
		51–60	Loamy sand or sand	SP or SM	A–3 or A–2
Catlin: 171B, 171C2, 171D2	5–10	0–10	Silt loam	CL, ML, or OL	A–6 or A–7
		10–52	Silty clay loam and clay loam	CL	A–6 or A–7
		52–60	Loam	ML or CL	A–4 or A–6
Clarksdale: 257	0–3	0–12	Silt loam	ML or CL	A–6
		12–44	Silty clay loam	CL	A–6 or A–7
		44–60	Silt loam	CL or ML	A–6 or A–4
Clinton: 18A, 18B, 18C2, 18D2, 18D3, 18E2	5–10	0–10	Silt loam	ML or CL	A–6
		10–47	Silty clay loam and silt loam	CL	A–6 or A–7
		47–60	Silt loam	CL or ML	A–6 or A–4
Denny: 45	0–3	0–17	Silt loam	CL	A–6 or A–7
		17–56	Silty clay and silty clay loam	CH	A–7
		56–60	Silt loam	CL	A–6 or A–7
*Dickinson: 974A, 974B, 974C2, 974D2. For properties of Onarga soils, see Onarga series.	5–10	0–16	Sandy loam	SM or SC	A–2 or A–4
		16–43	Sandy loam	SM or SC	A–2 or A–4
		43–60	Loamy sand or sand	SP or SM	A–2 or A–3
Drummer: 152	0–3	0–17	Silty clay loam	CL, CH, or OH	A–7
		17–47	Silty clay loam	CL or CH	A–7 or A–6
		47–60	Stratified loam, silt loam, sandy loam, and sand.	SM, SC, CL, or ML	A–2, A–4, or A–6
Elburn: 198	0–3	0–13	Silt loam	CL	A–6
		13–44	Silty clay loam	CL	A–6 or A–7
		44–60	Loam or sandy loam	ML or SM	A–4 or A–2
Elkhart: 567C2, 567D2	5–10	0–10	Silt loam	CL or ML	A–7 or A–6
		10–31	Silty clay loam	CL	A–7 or A–6
		31–60	Silt loam	CL	A–6
Fayette: 280	5–10	0–14	Silt loam	ML or CL	A–4 or A–6
		14–54	Silty clay loam and silt loam	CL	A–7 or A–6
		54–60	Silt loam	ML or CL	A–4 or A–6

See footnote at end of table.

engineering properties

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions column of this table. The symbol < means less than]

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosion potential for conduits (concrete)
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)	*Inches per hour*	*Inches per inch of soil*	*pH*		
100	95–100	25–60	2. 00–6. 30	0. 13–0. 15	5. 1–6. 5	Low.	
95–100	90–100	25–65	0. 63–6. 30	0. 14–0. 18	5. 1–6. 0	Low	Moderate.
95–100	85–100	0–20	6. 30–20. 0	0. 05–0. 07	5. 1–6. 5	Low	Moderate.
100	100	95–100	0. 63–2. 00	0. 20–0. 25	5. 6–7. 3	Low.	
100	95–100	95–100	0. 63–2. 00	0. 19–0. 21	5. 6–6. 5	Moderate	Moderate.
95–100	85–95	55–75	0. 20–2. 00	0. 14–0. 18	[2] 7. 4–8. 4	Low	Low.
100	100	90–100	0. 63–2. 00	0. 16–0. 18	[2] 7. 4–8. 4	Low	Low.
100	95–100	95–100	0. 63–2. 00	0. 20–0. 25	5. 6–6. 5	Low.	
95–100	90–100	60–90	0. 63–2. 00	0. 18–0. 21	5. 6–6. 5	Moderate	Moderate.
45–100	40–100	25–80	0. 63–6. 30	0. 16–0. 18	6. 6–7. 3	Low	Low.
100	100	95–100	0. 63–2. 00	0. 20–0. 25	5. 6–7. 3	Low.	
100	100	95–100	0. 63–2. 00	0. 19–0. 21	5. 6–6. 5	Moderate	Moderate.
100	85–100	0–20	6. 30–20. 0	0. 02–0. 04	6. 6–7. 8	Low	Low.
100	90–100	80–90	0. 20–0. 63	0. 20–0. 25	5. 1–6. 0	Low.	
100	90–100	85–95	0. 063–0. 20	0. 19–0. 21	5. 1–6. 0	Moderate or high	Moderate.
90–100	95–100	0–20	6. 30–20. 0	0. 02–0. 04	5. 1–7. 3	Low	Low.
100	100	95–100	0. 63–2. 00	0. 20–0. 25	5. 6–7. 3	Low.	
100	95–100	95–100	0. 63–2. 00	0. 19–0. 21	5. 6–6. 5	Moderate	Moderate.
95–100	85–95	55–75	0. 20–2. 00	0. 16–0. 20	[2] 7. 4–8. 4	Low	Low.
100	100	95–100	0. 63–2. 00	0. 20–0. 25	5. 6–6. 5	Low.	
100	100	95–100	0. 20–0. 63	0. 19–0. 21	5. 6–6. 5	Moderate	Moderate.
100	100	95–100	0. 63–2. 00	0. 18–2. 00	6. 6–7. 8	Low	Low.
100	100	95–100	0. 63–2. 00	0. 18–0. 23	4. 5–6. 5	Low.	
100	100	95–100	0. 20–0. 63	0. 19–0. 21	4. 5–6. 5	Moderate	Moderate.
100	100	95–100	0. 63–2. 00	0. 18–0. 21	5. 1–7. 8	Low	Low.
100	100	80–90	0. 20–0. 63	0. 20–0. 25	5. 6–6. 5	Low.	
100	100	85–100	0. 063–0. 20	0. 15–0. 18	5. 6–6. 0	Moderate or high	Moderate.
90–100	85–95	80–90	0. 20–0. 63	0. 18–0. 23	6. 0–7. 3	Low	Low.
95–100	95–100	25–40	2. 00–6. 30	0. 11–0. 17	5. 6–6. 5	Low.	
95–100	90–100	25–45	2. 00–6. 30	0. 10–0. 14	5. 6–6. 5	Low	Moderate.
95–100	85–100	0–20	6. 30–2. 00	0. 02–0. 06	5. 6–6. 5	Low	Moderate.
95–100	95–100	85–100	0. 63–2. 00	0. 21–0. 23	6. 1–7. 3	Moderate.	
95–100	95–100	85–100	0. 63–2. 00	0. 19–0. 21	6. 1–7. 3	Moderate	Low.
90–100	80–100	30–75	0. 63–2. 00	0. 19–0. 21	6. 6–7. 3	Low	Low.
100	100	90–100	0. 63–2. 00	0. 20–0. 25	5. 6–7. 3	Low.	
100	100	95–100	0. 63–2. 00	0. 19–0. 21	5. 6–7. 3	Moderate	Moderate.
90–100	80–90	25–60	0. 63–6. 30	0. 14–0. 18	6. 6–7. 3	Low	Low.
100	100	95–100	0. 63–2. 00	0. 20–0. 25	5. 6–7. 3	Low.	
100	100	95–100	0. 63–2. 00	0. 19–0. 21	5. 6–7. 3	Moderate	Moderate.
100	100	95–100	0. 63–2. 00	0. 18–0. 23	[2] 7. 4–8. 4	Low	Low.
100	100	95–100	0. 63–2. 00	0. 18–0. 23	5. 6–7. 3	Low.	
100	100	95–100	0. 63–2. 00	0. 19–0. 21	5. 6–6. 5	Moderate	Moderate.
100	100	95–100	0. 63–2. 00	0. 18–0. 20	5. 6–7. 8	Low	Low.

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TABLE 7.—*Estimated*

Soil series and map symbols	Depth to seasonal high water	Depth from surface [1]	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
Harpster: 67	0–3	0–16	Silty clay loam	CL, CH, or OH	A–7
		16–35	Silty clay loam	CL or CH	A–6 or A–7
		35–60	Silt loam	CL	A–6
Hartsburg: 244	0–3	0–17	Silty clay loam	CL, CH, or OH	A–7
		17–34	Silty clay loam	CL or CH	A–6 or A–7
		34–60	Silt loam	CL	A–6
*Hennepin: 964F	5–10	0–15	Loam	ML or CL	A–4 or A–6
For properties of Miami soils in mapping unit 964F, see Miami series.		15–50	Loam	ML or CL	A–4 or A–6
*Hickory: 963F2	5–10	0–7	Loam	ML or CL	A–4 or A–6
For properties of Sylvan soils in mapping unit 963F2, see Sylvan series.		7–46	Clay loam	CL	A–6
		46–60	Loam	CL or ML	A–4 or A–6
Huntsville: 77	[3] 5–10	0–36	Silt loam	CL or ML	A–6 or A–4
		36–60	Stratified silt loam and loam	CL or ML	A–6 or A–4
Ipava: 43	0–3	0–16	Silt loam	ML or CL	A–6 or A–7
		16–42	Silty clay loam	CH–MH, or CH	A–7
		42–60	Silt loam	ML or CL	A–6
Keomah: 17	0–3	0–12	Silt loam	ML or CL	A–6
		12–44	Silty clay loam and silt loam	CL	A–6 or A–7
		44–60	Silt loam	CL or ML	A–6 or A–4
Knight: 191	0–3	0–27	Silt loam	CL or OL	A–6 or A–7
		27–47	Silty clay loam and clay loam	CL	A–6 or A–7
		47–60	Stratified loam, sandy loam, and gravelly clay loam.	CL, SM or SC	A–2, A–4 or A–6
Lamont	5–10	0–8	Sandy loam	SM	A–2 or A–4
Mapped only in complexes with Alvin soils.		8–26	Sandy loam	SM or ML	A–2 or A–4
		26–60	Loamy sand or sand	SP or SM	A–2 or A–3
Lawndale: 683	0–3	0–18	Silt loam	ML or CL	A–6 or A–7
		18–44	Silty clay loam and silt loam	CH, MH, or CL	A–7
		44–60	Loamy sand or sand	SP or SM	A–2 of A–3
Lawson: 451	[3] 0–3	0–37	Silt loam	CL, ML, or CL	A–4 or A–6
		37–60	Stratified silt loam, loam, and sand.	CL, ML, SP, or SM	A–6, A–4 or A–2
*Miami: 966E2	5–10	0–8	Silt loam	ML or CL	A–4 or A–6
For properties of Russell soils in mapping unit 966E2, see Russell series. Miami soils also are in complexes with Birkbeck soils and in an undifferentiated group with Hennepin soils.		8–39	Clay loam	CL	A–6 or A–7
		39–60	Loam	ML or CL	A–4 or A–6
Middletown: 685B, 685C2, 685D2	5–10	0–8	Silt loam	ML or CL	A–6
		8–48	Silty clay loam and silt loam	CL	A–6 or A–7
		48–60	Loamy sand or sand	SP or SM	A–2 or A–3
Muscatine: 41	0–3	0–20	Silt loam	CL	A–6
		20–46	Silty clay loam and silt loam	CL	A–6 or A–7
		46–63	Silt loam	CL	A–6
Onarga	5–10	0–13	Sandy loam	SM or ML	A–2 or A–4
Mapped only in complexes with Dickinson soils.		13–35	Sandy clay loam and sandy loam.	SC or CL	A–6
		35–60	Loamy sand or sand	SP or SM	A–2 or A–3

See footnote at end of table.

engineering properties—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosion potential for conduits (concrete)
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
			Inches per hour	*Inches per inch of soil*	*pH*		
95–100	95–100	70–100	0. 63–2. 00	0. 19–0. 23	[2] 7. 4–8. 4	Moderate.	
100	100	95–100	0. 20–2. 00	0. 19–0. 21	[2] 7. 4–8. 4	Moderate	Low.
100	100	95–100	0. 63–2. 00	0. 18–0. 23	[2] 7. 4–8. 4	Low	Low.
100	100	95–100	0. 63–2. 00	0. 19–0. 23	6. 1–7. 3	Moderate.	
100	100	95–100	0. 63–2. 00	0. 19–0. 21	[2] 7. 4–8. 4	Moderate	Low.
100	100	95–100	0. 63–2. 00	0. 18–0. 23	[2] 7. 4–8. 4	Low	Low.
90–100	90–100	50–90	0. 63–2. 00	0. 14–0. 20	6. 6–7. 8	Low.	
90–100	80–100	50–80	0. 63–2. 00	0. 14–0. 18	[2] 7. 4–8. 4	Low	Low.
95–100	90–100	50–80	0. 63–2. 00	0. 16–0. 20	5. 6–7. 3	Low.	
95–100	90–100	55–85	0. 63–2. 00	0. 16–0. 19	5. 1–6. 0	Moderate	Moderate.
95–100	90–100	50–80	0. 20–2. 00	0. 14–0. 18	[2] 7. 4–8. 4	Low	Low.
100	95–100	85–100	0. 63–2. 00	0. 16–0. 20	6. 1–7. 8	Low	Low.
95–100	85–95	55–95	0. 63–2. 00	0. 14–0. 18	6. 1–7. 8	Low	Low.
100	100	95–100	0. 63–2. 00	0. 20–0. 25	5. 6–7. 3	Low.	
100	100	95–100	0. 20–2. 00	0. 18–0. 20	5. 6–6. 5	High	Moderate.
100	100	95–100	0. 63–2. 00	0. 18–0. 23	6. 6–8. 4	Low or moderate	Low.
100	100	95–100	0. 63–2. 00	0. 20–0. 25	5. 6–7. 3	Low.	
100	100	95–100	0. 20–0. 63	0. 18–0. 20	4. 5–7. 3	Moderate	Moderate.
100	100	95–100	0. 63–2. 00	0. 18–0. 20	6. 6–8. 4	Low	Low.
95–100	90–100	80–90	0. 63–2. 00	0. 20–0. 25	5. 1–6. 0	Low.	
95–100	90–100	75–90	0. 20–0. 63	0. 16–0. 19	5. 6–6. 0	Moderate	Moderate.
90–100	85–95	25–90	0. 63–2. 00	0. 10–0. 19	5. 6–7. 3	Low	Low.
100	95–100	25–40	2. 00–6. 30	0. 13–0. 15	5. 1–6. 0	Low.	
95–100	90–100	25–55	2. 00–6. 30	0. 12–0. 14	5. 1–6. 0	Low	Moderate.
95–100	85–100	0–20	6. 30–2. 00	0. 05–0. 07	5. 1–6. 5	Low	Moderate.
100	100	95–100	0. 63–2. 00	0. 20–0. 25	5. 6–7. 3	Low.	
100	100	95–100	0. 63–2. 00	0. 19–0. 21	5. 6–7. 3	Moderate	Moderate.
100	85–100	0–20	6. 30–20. 0	0. 02–0. 04	6. 6–7. 8	Low	Low.
100	95–100	85–100	0. 63–2. 00	0. 20–0. 25	6. 1–7. 8	Low	Low.
95–100	85–95	5–90	0. 63–2. 00	0. 04–0. 20	6. 1–7. 8	Low	Low.
100	95–100	55–80	0. 63–2. 00	0. 16–0. 20	5. 6–6. 5	Low.	
95–100	90–100	60–80	0. 63–2. 00	0. 16–0. 19	5. 1–6. 5	Moderate	Moderate.
90–100	80–100	55–75	0. 63–2. 00	0. 14–0. 18	[2] 7. 4–8. 4	Low	Low.
100	100	95–100	0. 63–2. 00	0. 18–0. 23	5. 1–7. 3	Low.	
100	100	95–100	0. 63–2. 00	0. 19–0. 21	4. 5–6. 5	Moderate	Moderate.
95–100	85–100	0–20	6. 30–20. 0	0. 02–0. 04	5. 1–7. 8	Low	Moderate.
100	100	95–100	0. 63–2. 00	0. 20–0. 25	5. 6–7. 3	Low.	
100	100	95–100	0. 63–2. 00	0. 19–0. 21	5. 6–6. 5	Moderate	Moderate.
100	100	95–100	0. 63–2. 00	0. 18–0. 22	6. 6–7. 8	Low	Low.
100	100	30–60	0. 63–2. 00	0. 13–0. 17	5. 6–6. 5	Low.	
100	95–100	40–70	0. 63–2. 00	0. 14–0. 18	5. 6–6. 5	Low or moderate	Moderate.
100	85–100	0–20	6. 30–20. 0	0. 04–0. 06	5. 6–6. 5	Low	Moderate.

TABLE 7.—*Estimated*

Soil series and map symbols	Depth to seasonal high water	Depth from surface [1]	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
Parr: 221C2, 221D2	5–10	0–9	Silt loam	ML or CL	A–4 or A–6
		9–31	Silty clay loam and clay loam	CL	A–6
		31–60	Loam	ML or CL	A–4 or A–6
Pillot: 159B, 159C2	5–10	0–15	Silt loam	ML or CL	A–4 or A–6
		15–36	Silty clay loam and sandy clay loam.	CL or SC	A–6 or A–7
		36–60	Loamy sand or sand	SP or SM	A–2 or A–3
Plano: 199A, 199B, 199C2	5–10	0–12	Silt loam	CL or ML	A–6 or A–4
		12–50	Silty clay loam	CL	A–6
		50–60	Loam or sandy loam	ML or SM	A–4 or A–2
Proctor: 148A, 148B, 148C2, 148D2	5–10	0–13	Silt loam	CL	A–6 or A–7
		13–55	Silty clay loam, clay loam, and sandy clay loam.	CL	A–6 or A–7
		55–60	Stratified loam, sandy loam, sand, and some fine gravel.	SC, SM or CL	A–2, A–4, or A–6
Radford: 74	[3] 0–3	0–26	Silt loam	ML or CL	A–4 or A–6
		26–60	Silty clay loam	CL	A–6 or A–7
Ross: 73	[3] 5–10	0–33	Loam	ML or CL	A–4 or A–6
		33–60	Loam	ML or CL	A–4 or A–6
Rushville: 16	0–3	0–16	Silt loam	CL–ML	A–4 or A–6
		16–48	Silty clay loam and silty clay	CL or CH	A–7
		48–60	Silt loam	CL or ML	A–6 or A–4
Russell. Mapped only in a complex with Miami soils.	5–10	0–7	Silt loam	ML or CL	A–4 or A–6
		7–48	Silty clay loam and clay loam	CL	A–6
		48–60	Loam	ML or CL	A–4 or A–6
Sable: 68	0–3	0–20	Silty clay loam	CH, CL, or OH	A–7
		20–51	Silty clay loam	CL or CH	A–6 or A–7
		51–60	Silt loam	CL	A–6
St. Charles: 243B, 243C2	5–10	0–7	Silt loam	CL or ML	A–6 or A–4
		7–45	Silty clay loam	CL	A–6
		45–70	Sandy clay loam or sandy loam and some sand and gravel.	SC, CL, or SM	A–2, A–4, or A–6
Sawmill: 107, 107+	[3] 0–3	0–27	Silty clay loam	CL, CH, or MH	A–7
		27–60	Silty clay loam	CL	A–6 or A–7
Shiloh: 138	[3] 0–3	0–32	Silty clay loam and silty clay	CH–MH	A–7
		32–60	Silty clay and silty clay loam	CH or CL	A–7
		60–70	Silt loam	CL	A–6
Sylvan. Mapped only in an undifferentiated group with Hickory soils.	5–10	0–9	Silt loam	ML or CL	A–4
		9–32	Silty clay loam	CL	A–6 or A–7
		32–60	Silt loam	ML or CL	A–4 or A–6
Tallula: 965D2. For properties of Bold soils in mapping unit 965D2, see the Bold series.	5–10	0–28	Silt loam	ML or ML–CL	A–4
		28–60	Silt loam	ML	A–4
Tama: 36A, 36B, 36C2, 36D2	5–10	0–13	Silt loam	CL or ML	A–7 or A–6
		13–53	Silty clay loam	CL	A–7 or A–6
		53–60	Silt loam	CL	A–6
Thebes: 212C2, 212D3, 212E2	5–10	0–5	Silt loam	ML or CL	A–4 or A–6
		5–31	Silty clay loam	CL	A–6 or A–7
		31–60	Loamy sand or sand	SP or SM	A–2 or A–3

See footnote at end of table.

engineering properties—Continued

Percentage passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosion potential for conduits (concrete)
			Inches per hour	*Inches per inch of soil*	*pH*		
100	95–100	85–95	0. 63–2. 00	0. 20–0. 25	5. 6–6. 5	Low.	
100	95–100	60–90	0. 63–2. 00	0. 16–0. 19	5. 6–7. 3	Moderate	Moderate.
95–100	85–95	60–70	0. 20–2. 00	0. 14–0. 18	[2] 7. 4–8. 4	Low	Low.
100	90–100	50–80	0. 63–2. 00	0. 20–0. 25	5. 6–6. 5	Low.	
100	90–100	35–60	0. 63–2. 00	0. 18–0. 20	5. 6–6. 0	Moderate	Moderate.
85–100	80–90	0–20	6. 30–20. 0	0. 02–0. 04	5. 6–7. 3	Low	Moderate.
100	100	95–100	0. 63–2. 00	0. 20–0. 25	5. 6–7. 3	Low.	
100	100	95–100	0. 63–2. 00	0. 19–0. 21	5. 6–6. 5	Low or moderate	Moderate.
90–100	80–90	25–60	0. 63–6. 30	0. 10–0. 14	6. 1–7. 3	Low	Low.
100	95–100	80–95	0. 63–2. 00	0. 20–0. 25	5. 6–7. 3	Low.	
95–100	90–100	60–90	0. 63–2. 00	0. 16–0. 19	5. 6–6. 5	Moderate	Moderate.
45–100	40–100	25–80	0. 63–6. 30	0. 12–0. 16	6. 1–7. 3	Low	Low.
95–100	90–100	80–100	0. 63–2. 00	0. 20–0. 25	6. 5–7. 3	Low	Low.
95–100	90–100	80–100	0. 63–2. 00	0. 19–0. 21	6. 5–7. 3	Moderate	Low.
100	95–100	50–80	0. 63–2. 00	0. 16–0. 20	5. 6–7. 3	Low	Low.
95–100	85–95	50–80	0. 63–2. 00	0. 14–0. 18	6. 1–7. 3	Low	Low.
100	100	95–100	0. 20–0. 63	0. 20–0. 25	5. 1–6. 5	Low.	
100	100	95–100	<0. 063	0. 15–0. 19	5. 1–6. 5	Moderate or high	Moderate.
100	100	95–100	0. 20–0. 63	0. 18–0. 23	6. 6–7. 8	Low	Low.
100	95–100	80–100	0. 63–2. 00	0. 20–0. 25	5. 6–7. 3	Low.	
95–100	90–100	70–95	0. 63–2. 00	0. 16–0. 19	5. 1–7. 3	Moderate	Moderate.
90–100	80–100	50–80	0. 63–2. 00	0. 14–0. 18	[2] 7. 4–8. 4	Low	Low.
100	100	95–100	0. 63–2. 00	0. 19–0. 23	6. 1–7. 3	Moderate.	
100	100	95–100	0. 63–2. 00	0. 19–0. 21	6. 1–7. 3	Moderate	Low
100	100	95–100	0. 63–2–00	0. 18–0. 23	6. 6–8. 4	Low	Low.
100	100	95–100	0. 63–2. 00	0. 20–0. 25	5. 6–7. 3	Low.	
100	100	95–100	0. 63–2. 00	0. 16–0. 19	4. 5–6. 5	Moderate	Moderate.
90–100	80–90	25–65	0. 63–6. 30	0. 10–0. 14	4. 5–7. 4	Low	Low.
100	95–100	90–100	0. 63–2. 00	0. 19–0. 23	6. 1–7. 3	Moderate	Low.
95–100	90–100	80–100	0. 20–2. 00	0. 19–0. 21	6. 1–7. 3	Moderate	Low.
100	100	95–100	0. 20–0. 63	0. 16–0. 19	6. 1–7. 8	High	Low.
100	100	95–100	0. 063–0. 20	0. 15–0. 18	7. 4–7. 8	High	Low.
100	100	95–100	0. 20–0. 63	0. 18–0. 23	6. 6–7. 3	Low	Low.
100	100	95–100	0. 63–2. 00	0. 18–0. 23	5. 6–6. 5	Low.	
100	100	95–100	0. 63–2. 00	0. 19–0. 21	5. 6–7. 3	Moderate	Moderate.
100	100	95–100	0. 63–2. 00	0. 18–0. 23	[2] 7. 4–8. 4	Low	Low.
100	100	85–100	0. 63–2. 00	0. 20–0. 25	6. 6–7. 3	Low.	
100	100	90–100	2. 00–6. 30	0. 18–0. 23	[2] 7. 4–8. 4	Low	Low.
100	100	95–100	0. 63–2. 00	0. 20–0. 25	5. 6–6. 5	Low	Low.
100	100	95–100	0. 63–2. 00	0. 19–0. 21	5. 6–6. 5	Moderate	Moderate.
100	100	95–100	0. 63–2. 00	0. 18–0. 23	6. 6–8. 4	Low	Low.
100	90–100	50–80	0. 63–2. 00	0. 20–0. 25	5. 6–6. 5	Low.	
100	90–100	60–90	0. 63–2. 00	0. 18–0. 20	5. 1–6. 0	Moderate	Moderate.
90–100	80–90	0–20	6. 30–20. 0	0. 05–0. 07	5. 6–7. 8	Low	Low.

TABLE 7.—*Estimated*

Soil series and map symbols	Depth to seasonal high water	Depth from surface [1]	Classification: USDA texture	Unified	AASHO
	Feet	*Inches*			
Tice: 284	[3] 0–3	0–14	Silty clay loam	CL or CH	A–6 or A–7
		14–35	Silty clay loam	CL or CH	A–6 or A–7
		35–60	Stratified silt loam, loam, and sandy loam.	CL, ML, or SM	A–6, A–4, or A–2

[1] In some of the eroded soils (eroded soils, in their map symbol, have the numeral 2 following the slope letter), the surface layer is thinner than that indicated. In severely eroded soils (soils having the numeral 3 following the slope letter in their symbol), the original surface layer is missing and the second layer is exposed or nearly so.

TABLE 8.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series that appear

Soil series and map symbol	Suitability as a source of—: Topsoil	Suitability as a source of—: Sand and gravel	Suitability as a source of—: Road fill	Degree and kind of limitations affecting sewage disposal: Sewage lagoons	Degree and kind of limitations affecting sewage disposal: Septic tank filter fields	Soil features affecting—: Highway location
*Alvin: 975C2, 975D2, 975E. For Lamont part, see Lamont series.	Poor in upper 15 inches: droughty; low fertility.	Good for sand below depth of about 3 feet; poorly graded; contains some fines in places.	Fair or poor above depth of about 3 feet. Fair or good below depth of about 3 feet if confined or if soil binder is added.	Severe: highly porous; danger of ground water pollution.	Moderate for 975C2 and 975D2, severe for 975E because of slope: highly porous material; danger of ground water contamination.	Exposed sand below depth of about 3 feet is highly erodible; loose sand hinders hauling operations.
*Birkbeck: 233B, 233C2, 968D2, 968D3. For Miami part of 968D2 and 968D3, see Miami series.	Fair or good in upper 6 inches: moderate fertility.	Unsuitable: fine-grained material.	Fair or poor in upper 6 inches; poor in subsoil: plastic; moderate shrink-swell potential.	Moderate because of slope.	Slight for 233B, moderate for 233C2 because of slope.	Susceptible to frost heave; cuts and fills needed.
Bold. Mapped only in a complex with Tallula soils.	Poor: low fertility; highly erodible.	Unsuitable: fine-grained material.	Fair: low shrink-swell potential; highly erodible.	Severe: slopes of 6 to 15 percent.	Moderate to severe: slopes of 6 to 15 percent; difficulty in construction and function where slopes are over 12 percent.	Sloping topography; cuts and fills needed; highly erodible.

engineering properties—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosion potential for conduits (concrete)
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
			Inches per hour	*Inches per inch of soil*	*pH*		
100	100	95–100	0.63–2.00	0.19–0.23	6.1–7.3	Moderate.	
100	100	95–100	0.63–2.00	0.19–0.23	6.1–7.3	Moderate	Low.
95–100	85–95	25–90	0.63–2.00	0.11–0.13	6.1–7.3	Moderate or low	Low.

[2] Calcareous.
[3] Soils are subject to overflow.

interpretations

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions in the first column of this table]

Soil features affecting—Continued							
Winter grading	Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
		Reservoir areas	Embankments				
Loose sand; traction difficult to obtain.	Poor stability unless confined; low shear strength.	Highly permeable; excessive seepage is likely.	Sandy material; excessive seepage; difficult to vegetate; piping hazard.	Naturally well drained and moderately well drained; moderate or moderately rapid permeability.	Sloping; moderate available water capacity; moderate or moderately rapid water-intake rate.	Sandy; droughty; difficult to vegetate; moderate or moderately rapid permeability.	Sandy; droughty; difficult to vegetate; low fertility.
Plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Moderate permeability; slight seepage; few soil features that limit use as reservoir.	Subsoil material has fair or good stability; material below subsoil has poor to good stability and compaction.	Naturally moderately well drained; moderate permeability.	Sloping; high available water capacity; subject to erosion.	Mostly short, irregular slopes; exposed subsoil is clayey and moderate in fertility.	Moderate fertility in exposed subsoil; high available water capacity.
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Low shrink-swell potential.	Moderate permeability; most soil features favorable.	Poor stability and compaction.	Well and moderately well drained; moderate permeability in subsoil.	Sloping; high available water capacity; moderate water-intake rate; subject to erosion.	Short and irregular slopes; exposed subsoil is low in fertility; highly erodible.	Low fertility in exposed subsoil; high available water capacity; highly erodible.

TABLE 8.—*Engineering*

Soil series and map symbol	Suitability as a source of—			Degree and kind of limitations affecting sewage disposal		Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Sewage lagoons	Septic tank filter fields	Highway location
Brenton: 149	Good in upper 14 inches: high fertility.	Good: sand below depth of about 3½ feet; thickness of sand varies from place to place.	Fair or poor above depth of 14 inches; poor in subsoil: plastic; moderate shrink-swell potential. Fair below depth of about 4 feet.	Moderate: moderate permeability; highly porous material below depth of about 4 feet; danger of ground water contamination.	Moderate or severe: seasonal high water table at depth of less than 3 feet.	Nearly level; susceptible to frost heave; seasonal high water table within 3 feet of surface.
Broadwell: 684A, 684B, 684C2, 684D2.	Good in upper 15 inches: high fertility.	Fair for sand below depth of about 4 feet; thickness of sand varies from place to place; contains some fines in places.	Poor: subsoil is plastic; moderate shrink-swell potential. Good or fair below depth of about 4 feet if confined or if soil binder is used.	Slight for 684A, moderate for 684B and 684C2, and severe for 684D2, because of slope: highly porous material below depth of about 4 feet; danger of ground water contamination.	Slight for 684A and 684B, moderate for 684C2 and 684D2 because of slope: highly porous material below depth of about 4 feet; danger of ground water contamination.	Nearly level to strongly sloping; some cuts and fills needed. Highly erodible sand below depth of about 4 feet.
Brooklyn: 136	Fair or good in upper 16 inches: moderate fertility.	Fair for sand below depth of about 4 feet; thickness of sand ranges from less than 1 foot to as much as 4 or 5 feet; contains some fines in places.	Poor: subsoil is highly plastic; seasonal high water table.	Severe: highly porous material below depth of about 4 feet; danger of ground water contamination.	Severe: slow permeability; seasonal high water table.	Depressional; subject to ponding; seasonal high water table; susceptible to frost heave.
Catlin: 171B, 171C2, 171D2.	Good in upper 8 inches: high fertility.	Unsuitable: fine-grained material.	Poor above depth of 8 inches; subsoil is poor; plastic; moderate shrink-swell potential.	Moderate for 171B and 171C2, severe for 171D2 because of slope.	Slight for 171B, moderate for 171C2 and 171D2 because of slope.	Susceptible to frost heave; cuts and fills needed.

See footnote at end of table.

interpretations—Continued

Soil features affecting—Continued							
Winter grading	Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
		Reservoir areas	Embankments				
Seasonal high water table; plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil; seasonal high water table; excavations fill with water; basements and foundations are wet.	Seasonal high water table; more suitable for dug ponds; highly permeable material below depth of about 4 feet.	Fair or good stability and compaction; some seepage likely with material taken below depth of about 4 feet.	Naturally somewhat poorly drained; moderate permeability; seasonal high water table.	Nearly level; very high available water capacity; high fertility; moderate water-intake rate.	(1) ----------	(1).
Plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Highly permeable material below depth of about 4 feet; excessive seepage is likely.	Subsoil material has fair or poor stability and compaction; sandy material below depth of about 4 feet; excessive seepage likely.	Naturally well and moderately well drained; moderate permeability.	Nearly level and sloping; high available water capacity; moderate water-intake rate.	Slopes are short in some places; exposed subsoil is clayey and moderate in fertility.	Moderate fertility in exposed subsoil; high available water capacity; most soil features are favorable.
Seasonal high water table; poor surface drainage.	Moderate or high shrink-swell potential; subject to ponding; excavations fill with water; basements and foundations are wet.	Seasonal high water table; highly permeable material below depth of about 4 feet.	Poor to good stability and compaction; clayey material in subsoil; high volume change; highly permeable material below depth of about 4 feet.	Naturally poorly drained; slow permeability; seasonal high water table; subject to ponding; depressional.	Depressional; high available water capacity; slow permeability; slow water-intake rate; subject to ponding.	(1)----------	(1).
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil. Low shrink-swell potential below subsoil.	Moderate permeability; slight seepage rate; most soil features are favorable.	Fair or good stability and compaction of subsoil; poor to good stability and compaction of material below subsoil.	Naturally well and moderately well drained.	Sloping; high available water capacity; subject to erosion; moderate water-intake rate.	Mostly short, irregular slopes; exposed subsoil material is clayey.	Naturally well and moderately well drained; high available water capacity; most soil features are favorable.

TABLE 8.—*Engineering*

Soil series and map symbol	Suitability as a source of—			Degree and kind of limitations affecting sewage disposal		Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Sewage lagoons	Septic tank filter fields	Highway location
Clarksdale: 257	Good in upper 12 inches: moderate to high fertility.	Unsuitable: fine-grained material.	Fair or poor: plastic subsoil; moderate shrink-swell potential.	Moderate: permeability is moderately slow.	Severe: moderately slow permeability; seasonal high water table within 3 feet of surface.	Susceptible to frost heave; nearly level topography; seasonal high water table within 3 feet of surface.
Clinton: 18A, 18B, 18C2, 18D2, 18D3, 18E2.	Fair or good in upper 10 inches for 18A, 18B, and upper 8 inches for 18C2, 18D2, 18D3, and 18E2: moderate fertility.	Unsuitable: fine-grained material.	Fair or poor: plastic in subsoil; moderate shrink-swell potential.	Slight for 18A, moderate for 18B and 18C2, severe for 18D2, 18D3, and 18E2 because of slope.	Moderate for 18A, 18B, 18C2, 18D2, and 18D3 because of moderately slow permeability; severe for 18E2 because of slope.	Sloping topography; cuts and fills needed; seasonal high water table within 5 to 10 feet of surface.
Denny: 45	Fair or good in upper 17 inches: moderate fertility.	Unsuitable: fine-grained material in Denny soils on uplands. Denny soils on terraces good for sand and gravel below depth of about 5 feet.	Poor: subsoil is highly plastic; seasonal high water table; moderate to high shrink-swell potential in subsoil.	Slight: depressional; slow permeability.	Severe: slow permeability; seasonal high water table.	Susceptible to frost heave; depressional; subject to ponding; seasonal high water table within 3 feet of surface.
*Dickinson: 974A, 974B, 974C2, 974D2. For Onarga part, see Onarga series.	Fair in upper 16 inches for 974A, 974B, and upper 8 inches for 974C2, 974D2: droughty; moderate fertility.	Good for sand: poorly graded; contains some fines in places.	Good if confined or if soil binder is used.	Severe: highly porous material; danger of ground water contamination.	Slight for 974A and 974B, moderate for 974C2 and 974D2 because of slope: danger of ground water contamination; highly porous material.	Exposed sand below depth of about 3 feet is highly erodible; loose sand hinders hauling operations.

See footnote at end of table.

interpretations—Continued

Soil features affecting—Continued							
Winter grading	Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
		Reservoir areas	Embankments				
Seasonal high water table; soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil; seasonal high water table; wet basements and foundations.	Moderately slow permeability suitable for dug-out ponds; seasonal high water table.	Poor to good stability and compaction; subject to piping if not properly compacted.	Naturally somewhat poorly drained; moderately slow permeability; seasonal high water table.	Nearly level slopes; very high available water capacity; moderate or slow water-intake rate.	(1)	(1).
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Moderately slow permeability; most soil features are favorable.	Poor to good stability and compaction; subject to piping if not properly compacted.	Naturally well and moderately well drained; moderately slow permeability.	Sloping; high or very high available water capacity; moderately slow permeability; subject to erosion; moderate or slow water-intake rate.	Short and irregular slopes; exposed subsoil is clayey and moderate in fertility; construction is difficult where slopes exceed 12 percent.	Moderate fertility in exposed subsoil; high available water capacity; most soil features are favorable; steeper slopes present difficulties in construction and in establishing and maintaining vegetation.
Seasonal high water table; poor surface drainage.	Moderate or high shrink-swell potential; subject to ponding; excavations fill with water; basements and foundations are wet.	Depressional; suitable for dug-out ponds; seasonal high water table.	Poor to good stability and compaction; clayey material in subsoil; high volume change.	Naturally poorly drained; slow permeability; seasonal high water table; subject to ponding; depressional.	Depressional; high available water capacity; slow permeability; slow water intake-rate; subject to ponding.	(1)	(1).
Loose sand; traction difficult.	Poor stability unless confined; low shear strength.	Highly permeable material; excessive seepage is likely.	Sandy material; excessive seepage is likely; difficult to vegetate; piping hazard.	Naturally well and somewhat excessively drained; moderately rapid to rapid permeability.	Sloping; low available water capacity.	Sandy material; droughty; difficult to vegetate; moderate fertility.	Sandy material; droughty; difficult to vegetate; moderate fertility.

TABLE 8.—*Engineering*

Soil series and map symbol	Suitability as a source of—			Degree and kind of limitations affecting sewage disposal		Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Sewage lagoons	Septic tank filter fields	Highway location
Drummer: 152	Fair in upper 15 inches: clayey material is sticky when wet; cloddy and hard when dry; high fertility.	Good: sand below depth of about 4 feet; seasonal high water table will hinder excavation.	Poor: highly plastic in subsoil; moderate shrink-swell potential; seasonal high water table.	Severe: highly porous material below depth of about 4 feet; danger of ground water contamination.	Severe: seasonal high water table within 3 feet of surface; highly porous material below depth of about 4 feet; danger of ground water contamination.	Seasonal high water table within 3 feet of surface; nearly level; susceptible to frost heave.
Elburn: 198	Good in upper 13 inches: high fertility.	Good: sand below depth of about 4 feet; seasonal high water table will hinder excavation.	Poor in subsoil: plastic; fair or good below depth of about 4 feet.	Severe: highly porous material below depth of about 4 feet; danger of ground water contamination.	Severe: seasonal high water table within 3 feet of surface; highly porous material below depth of about 4 feet; danger of ground water contamination.	Nearly level; seasonal high water table within 3 feet of surface.
Elkhart: 567C2, 567D2.	Good in upper 8 inches: high fertility.	Unsuitable: fine-grained material.	Poor in subsoil: plastic; moderate shrink-swell potential.	Moderate for 567C2, severe for 567D2 because of slope.	Moderate for 567C2 and 567D2 because of slope.	Sloping; cuts and fills needed; well drained.
Fayette: 280	Fair or good in upper 14 inches: moderate fertility.	Good: stratified sand and gravel below depth of about 5 feet.	Poor in subsoil: moderate shrink-swell potential; good below depth of about 5 feet.	Moderate: permeability is moderate; highly porous material below depth of about 5 feet; danger of ground water contamination.	Slight: moderate permeability; highly porous material below depth of about 5 feet; danger of ground water contamination.	Nearly level; well drained.

See footnote at end of table.

interpretations—Continued

Soil features affecting—Continued							
Winter grading	Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
		Reservoir areas	Embankments				
Seasonal high water table; poor surface drainage.	Moderate shrink-swell potential; seasonal high water table; excavations fill with water; basements and foundations are wet.	Seepage is likely below depth of about 4 feet.	Poor to good stability and compaction; seepage is likely with material taken below depth of about 4 feet.	Naturally poorly drained; moderate permeability; seasonal high water table.	Nearly level; very high available water capacity; moderate permeability; seasonal high water table; moderate water-intake rate.	(1)	(1).
Seasonal high water table; soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; seasonal high water table; excavations fill with water; basements and foundations are wet.	Porous material below depth of about 4 feet.	Poor to good stability and compaction; seepage is likely with material taken below depth of about 4 feet.	Naturally somewhat poorly drained; moderate permeability; seasonal high water table.	Nearly level; high or very high available water capacity; moderate permeability; moderate water-intake rate; seasonal high water table.	(1)	(1).
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Moderate permeability; most soil features are favorable.	Fair or good stability and compaction.	Naturally well drained; moderate permeability.	Sloping; high available water capacity; moderate water-intake rate.	Short slopes; exposed subsoil is clayey and moderate in fertility.	Moderate fertility in exposed subsoil; high available water capacity; most soil features favorable.
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Highly permeable material below depth of 5 feet; excessive seepage is likely.	Poor to good stability and compaction above depth of about 5 feet; highly porous material below about 5 feet.	Naturally well drained; moderate permeability.	Nearly level; high or very high available water capacity; moderate water-intake rate.	(1)	(1).

TABLE 8.—*Engineering*

Soil series and map symbol	Suitability as a source of—			Degree and kind of limitations affecting sewage disposal		Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Sewage lagoons	Septic tank filter fields	Highway location
Harpster: 67	Fair in upper 16 inches: clayey, sticky when wet and cloddy when dry; high fertility.	Unsuitable: fine-grained material.	Poor: highly plastic; moderate shrink-swell potential in subsoil.	Moderate: permeability is moderate to moderately slow.	Severe: seasonal high water table within 3 feet of surface; subject to ponding.	Nearly level or depressional; seasonal high water table within 3 feet of surface; subject to ponding; susceptible to frost heave.
Hartsburg: 244	Fair in upper 19 inches: clayey, sticky when wet and cloddy and hard when dry; high fertility.	Unsuitable: fine-grained material.	Poor: highly plastic; moderate shrink-swell potential.	Moderate: permeability is moderate.	Severe: seasonal high water table within 3 feet of surface; subject to ponding.	Nearly level or depressional; seasonal high water table within 3 feet of surface. Subject to ponding; susceptible to frost heave.
*Hennepin: 964F For Miami part, see Miami series.	Poor: contains stones of various sizes; moderate fertility.	Unsuitable: high percentage of fines.	Fair or poor: low shrink-swell potential; contains stones of various sizes.	Severe: slope too steep.	Severe: slope too steep.	Steep and very steep slopes; cuts and fills needed; seepy areas likely; highly erodible in cuts and fills.
*Hickory: 963F2 For Sylvan part, see Sylvan series.	Fair or good in upper 7 inches: moderate fertility.	Unsuitable: fine-grained material.	Fair or poor: plastic; moderate shrink-swell potential in subsoil.	Severe: steep slopes are hazard.	Severe: steep slopes are hazard in construction and function.	Steep and very steep slopes; cuts and fills needed; highly erodible in cuts and fills; seepage areas likely.

See footnote at end of table.

interpretations—Continued

Soil features affecting—Continued							
Winter grading	Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
		Reservoir areas	Embankments				
Seasonal high water table; soils highly plastic when wet.	Moderate shrink-swell potential; seasonal high water table; subject to ponding; excavations fill with water; basements and foundations are wet.	Suitable for dug-out ponds; seasonal high water table.	Poor to good stability and compaction; clayey material; high volume change.	Naturally poorly drained; moderate to moderately slow permeability; seasonal high water table; subject to ponding.	Nearly level or depressional; high available water capacity; moderate to moderately slow permeability; moderate water-intake rate; seasonal high water table; subject to ponding.	(1)	(1).
Seasonal high water table; soils highly plastic when wet.	Moderate shrink-swell potential; seasonal high water table; subject to ponding; excavations fill with water; basements and foundations are wet.	Suitable for dug-out ponds; seasonal high water table.	Poor to good stability and compaction; clayey material; moderate volume change.	Naturally poorly and very poorly drained; moderate permeability; seasonal high water table; subject to ponding.	Nearly level or depressional; high or very high available water capacity; moderately permeable; moderate water-intake rate; seasonal high water table; subject to ponding.	(1)	(1).
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Steep and very steep slopes cause construction difficulties.	Moderate permeability; possible small sand or gravel pockets; most soil features are favorable.	Poor to good stability and compaction.	Naturally well drained; moderate permeability.	Slopes too steep.	(1)	(1).
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Steep slopes cause construction difficulties; moderate shrink-swell potential in subsoil.	Moderate permeability; most soil features are favorable.	Poor to good stability and compaction; moderate volume change.	Naturally well drained and moderately well drained; moderate permeability.	Steep slopes	(1)	(1).

TABLE 8.—*Engineering*

Soil series and map symbol	Suitability as a source of— Topsoil	Suitability as a source of— Sand and gravel	Suitability as a source of— Road fill	Degree and kind of limitations affecting sewage disposal: Sewage lagoons	Degree and kind of limitations affecting sewage disposal: Septic tank filter fields	Soil features affecting— Highway location
Huntsville: 77	Good in upper 36 inches: high fertility.	Unsuitable: fine-grained material.	Fair or poor: not always accessible in bottom land.	Severe: subject to overflow.	Severe: subject to overflow.	Nearly level; subject to overflow.
Ipava: 43	Good in upper 16 inches: high fertility.	Unsuitable: fine-grained material.	Poor: highly plastic; high shrink-swell potential in subsoil.	Slight or moderate: moderate or moderately slow permeability.	Severe: moderate or moderately slow permeability; seasonal high water table within 3 feet of surface.	Nearly level; seasonal high water table within 3 feet of surface; susceptible to frost heave.
Keomah: 17	Fair or good in upper 12 inches: moderate fertility.	Unsuited: fine-grained material.	Poor: subsoil is plastic and has moderate shrink-swell potential.	Slight: moderately slow permeability.	Severe: moderately slow permeability; seasonal high water table.	Nearly level; seasonal high water table within 3 feet of surface; susceptible to frost heave.
Knight: 191	Fair or good in upper 27 inches: moderate fertility.	Good for sand and gravel below depth of about 4 feet.	Poor: subsoil is plastic; seasonal high water table.	Slight: moderately slow permeability; highly porous material below depth of about 4 or 5 feet; danger of ground water contamination.	Severe: moderately slow permeability.	Depressional; subject to ponding; seasonal high water table; susceptible to frost heave.
Lamont Mapped only in a complex with Alvin soils.	Poor: droughty; low fertility.	Good for sand: poorly graded; contains some fines in places.	Good if confined or if soil binder is added.	Severe: highly porous; danger of ground water contamination.	Moderate where slopes are 2 to 12 percent, severe where slopes are more than 12 percent; highly porous material.	Exposed sand below about 2 feet is highly erodible; loose sand hinders hauling operations.

See footnote at end of table.

interpretations—Continued

Soil features affecting—Continued							
Winter grading	Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
		Reservoir areas	Embankments				
Difficult to break frozen clods and to compact the material.	Low shrink-swell potential; subject to overflow.	Subject to overflow.	Poor to good stability and compaction.	Naturally well drained and moderately well drained; moderate permeability.	Nearly level; very high available water capacity; moderate water-intake rate; subject to overflow.	(1)___________	(1).
Seasonal high water table; soils plastic when wet; difficult to break frozen clods and to compact the material.	Subsoil has high shrink-swell potential; seasonal high water table; excavations fill with water; basements and foundations are wet.	Moderate or moderately slow permeability.	Fair or poor stability and compaction.	Naturally somewhat poorly drained; moderate or moderately slow permeability; seasonal high water table.	Nearly level; very high available water capacity; moderate or slow water-intake rate.	(1)___________	(1).
Seasonal high water table; soils plastic when wet; difficult to break clods and to compact the material.	Moderate shrink-swell potential; seasonal high water table; excavations fill with water; basements and foundations are wet.	Suitable for dug-out ponds; seasonal high water table.	Poor to good stability and compaction.	Naturally somewhat poorly drained; moderately slow permeability.	Nearly level; high or very high available water capacity; moderate or slow water-intake rate.	(1)___________	(1).
Seasonal high water table; poor surface drainage.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil; subject to ponding; excavations fill with water; basements and foundations are wet.	Seasonal high water table; highly permeable material below depth of about 4 or 5 feet.	Poor to good stability and compaction; clayey material in subsoil; high volume change; highly permeable material below depth of about 4 or 5 feet.	Naturally poorly drained; moderately slow permeability; seasonal high water table; subject to ponding; depressional.	Depressional; high available water capacity; slow or moderately slow water-intake rate; subject to ponding.	(1)___________	(1).
Loose sand; traction is difficult to obtain.	Poor stability unless confined; low shear strength.	Highly permeable; excessive seepage likely; danger of ground water contamination.	Sandy material; excessive seepage; difficult to vegetate; piping hazard.	Naturally well drained; moderately rapid permeability.	Sloping; low available water capacity; rapid water-intake rate.	Sandy material; droughty; difficult to vegetate; moderately rapid permeability.	Sandy; droughty; difficult to vegetate; low fertility.

450-965—74——7

TABLE 8.—*Engineering*

Soil series and map symbol	Suitability as a source of—			Degree and kind of limitations affecting sewage disposal		Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Sewage lagoons	Septic tank filter fields	Highway location
Lawndale: 683	Good in upper 18 inches: high fertility.	Fair for sand below depth of about 4 feet; thickness of sand ranges from less than a foot to as much as 4 or 5 feet; contains some fines in places.	Poor in subsoil: highly plastic. Good or fair below depth of about 4 feet if confined or if soil binder is used; seasonal high water table.	Severe: highly porous material below depth of about 4 feet; danger of ground water contamination.	Severe: seasonal high water table within 3 feet of surface; highly porous material below depth of about 4 feet; danger of ground water contamination.	Susceptible to frost heave; nearly level; seasonal high water table within 3 feet of surface.
Lawson: 451	Good in upper 37 inches: high fertility.	Unsuited: fine-grained material.	Fair or poor: not always accessible in bottom land.	Severe: subject to overflow; seasonal high water table.	Severe: subject to overflow; seasonal high water table.	Nearly level; subject to overflow; seasonal high water table within 3 feet of surface; susceptible to frost heave.
*Miami: 966E2 For Russell part, see Russell series.	Fair or good in upper 8 inches: moderate fertility.	Unsuitable: high percentage of fines.	Fair or poor: subsoil is plastic; moderate shrink-swell potential; low shrink-swell potential below subsoil.	Severe: strongly sloping to very steep.	Moderate for 968D2, severe for 964F.	Strongly sloping to very steep slopes; cuts and fills needed; seepy areas likely; highly erodible in cuts and fills.
Middletown: 685B, 685C2, 685D2.	Fair or good in upper 8 inches: moderate fertility.	Fair for sand below depth of about 4 feet; thickness of sand ranges from less than 1 foot to as much as 4 or 5 feet; contains some fines in places.	Poor: plastic in subsoil; moderate shrink-swell potential. Good or fair below subsoil if confined or if soil binder is used.	Slope limitation moderate for 685B and 685C2, severe for 685D2. Highly porous material below depth of about 4 feet; danger of ground water contamination.	Slope limitation slight for 685B, moderate for 685C2 and 685D2; highly porous material below depth of about 4 feet; danger of ground water contamination.	Sloping; cuts and fills needed; sand below depth of about 4 feet is highly erodible.

See footnote at end of table.

interpretations—Continued

Soil features affecting—Continued								
Winter grading	Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
		Reservoir areas	Embankments				
Seasonal high water table; soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil; seasonal high water table; basements and foundations are wet.	Rapid permeability below depth of about 4 feet; sandy; excessive seepage is likely.	Fair or poor stability and compaction of subsoil material; sandy material below depth of about 4 feet; excessive seepage likely.	Naturally somewhat poorly drained; moderate permeability; seasonal high water table.	Nearly level; very high available water capacity; moderate water-intake rate.	(1)	(1).
Seasonal high water table; subject to overflow.	Low shrink-swell potential; seasonal high water table; subject to overflow; excavations fill with water; basements and foundations are wet.	Variable material below depth of about 4 feet; excessive seepage is possible; seasonal high water table; subject to overflow.	Fair or poor stability and compaction.	Naturally somewhat poorly drained; moderate permeability; subject to overflow; seasonal high water table.	Nearly level; very high available water capacity; moderate water-intake rate; subject to overflow.	(1)	(1).
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Slopes cause construction difficulties; moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Moderate permeability; possible small sand or gravel pockets; most soil features are favorable.	Poor to good stability and compaction.	Naturally well drained; moderate permeability.	High available water capacity; moderate water-intake rate; subject to erosion; sloping to very steep.	(1)	(1).
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Highly permeable material below depth of about 4 feet; excessive seepage is likely.	Poor to good stability and compaction; highly permeable material below depth of about 4 feet.	Naturally well and moderately well drained; moderate permeability.	Sloping; subject to water erosion; high available water capacity; moderate water-intake rate.	Short and irregular slopes; exposed subsoil is moderate in fertility.	Moderate fertility in exposed subsoil; high available water capacity; most soil features are favorable.

TABLE 8.—*Engineering*

Soil series and map symbol	Suitability as a source of—			Degree and kind of limitations affecting sewage disposal		Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Sewage lagoons	Septic tank filter fields	Highway location
Muscatine: 41	Good in upper 20 inches: high fertility.	Good: stratified sand and gravel below depth of about 5 feet.	Good below depth of about 5 feet; poor in subsoil; subsoil is plastic; moderate shrink-swell potential.	Severe: highly porous material below depth of about 5 feet; danger of ground water contamination.	Severe: seasonal high water table within 3 feet of surface; highly porous material below depth of about 5 feet; danger of ground water contamination.	Nearly level; seasonal high water table within 3 feet of surface.
Onarga. Mapped only in complexes with Dickinson soils.	Fair in upper 8 to 16 inches: droughty; moderate fertility.	Good for sand below depth of about 3 feet; poorly graded; contains some fines in places.	Fair or poor above depth of about 3 feet; fair or good below depth of about 3 feet if confined or if soil binder is used.	Severe: highly porous material; danger of ground water contamination.	Slight for 974A and 974B, moderate for 974C and 974D2: danger of ground water contamination.	Exposed sand below depth of about 3 feet is highly erosive; loose sand hinders hauling operations.
Parr: 221C2, 221D2	Good in upper 9 inches: moderate fertility.	Unsuitable: fine-grained material.	Fair or poor: subsoil is plastic; moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Moderate for 221C2, severe for 221D2 because of slope.	Moderate for 221C2 and 221D2 because of slope.	Sloping topography; cuts and fills needed.
Pillot: 159B, 159C2	Good in upper 15 inches for 159B, and upper 8 inches for 159C2; high fertility.	Fair for sand below depth of about 3 feet; extent of sand varies from place to place; contains some fines.	Poor in subsoil: plastic. Good or fair below subsoil if confined or if soil binder is added.	Severe: highly permeable material at a depth of about 3 feet; danger of ground water contamination.	Slope limitation slight for 159B, moderate for 159C2, moderate permeability; however, highly porous material below depth of about 3 feet; danger of ground water contamination.	Cuts and fills needed; erodible sand below depth of about 3 feet hinders hauling operations.

See footnote at end of table.

interpretations—Continued

Soil features affecting—Continued							
Winter grading	Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
		Reservoir areas	Embankments				
Seasonal high water table; soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; seasonal high water table; basements and foundations are wet.	Rapid permeability below depth of about 5 feet.	Fair or good stability and compaction; excessive seepage is likely with material taken below depth of about 5 feet.	Naturally somewhat poorly drained; moderate permeability.	Nearly level; very high available water capacity; moderate water-intake rate.	(1)	(1).
Loose sand; traction difficult.	Poor stability unless confined; low shear strength.	Highly permeable material; excessive seepage is likely.	Sandy material; excessive seepage is likely; difficult to vegetate; piping hazard.	Naturally well and moderately well drained; moderate or moderately rapid permeability.	Sloping; moderate available water capacity.	Sandy material; droughty; difficult to vegetate; moderate to moderately rapid permeability.	Sandy material; droughty; difficult to vegetate; moderate fertility.
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Moderate permeability; most soil fetaures are favorable.	Fair or good stability and compaction.	Naturally well drained; moderate permeability.	Sloping; high available water capacity; subject to erosion.	Short and irregular slopes; exposed subsoil is clayey, contains pebbles and stones; moderate in fertility.	Moderate fertility in exposed subsoil; high available water capacity; most soil features favorable.
Soils plastic above about 3 feet; difficult to break frozen clods and to compact the material; loose sand below depth of about 3 feet; traction difficult.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Rapid permeability below depth of about 3 feet; sandy; excessive seepage is likely.	Fair or good stability and compaction; excessive seepage is likely with material taken below depth of about 3 feet.	Naturally well drained; moderate permeability.	Sloping; moderate available water capacity; moderate water-intake rate; subject to erosion.	Short and irregular slopes; exposed subsoil is clayey; deep cuts expose sand that is droughty and low in fertility.	Moderate fertility in exposed subsoil; moderate available water capacity; deep cuts expose droughty sand that is low in fertility.

TABLE 8.—*Engineering*

Soil series and map symbol	Suitability as a source of—			Degree and kind of limitations affecting sewage disposal		Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Sewage lagoons	Septic tank filter fields	Highway location
Plano: 199A, 199B, 199C2.	Good in upper 12 inches for 199A, 199B, and upper 8 inches for 199C2; high fertility.	Good: sand below depth of about 4 feet.	Poor in subsoil: subsoil is plastic. Fair or good below depth of about 4 feet.	Slope limitation slight for 199A, moderate for 199B and 199C2; moderate permeability; however, highly porous material below depth of about 4 feet; danger of ground water contamination.	Slope limitation slight for 199A and 199B, moderate for 199C2; however, highly porous material below depth of about 4 feet; danger of ground water contamination.	Nearly level in some places and sloping in others.
Proctor: 148A, 148B, 148C2, 148D2.	Good in upper 13 inches for 148A, 148B, and upper 8 inches for 148C2, 148D2; high fertility.	Good: stratified sand or gravel below depth of about 4½ feet. Thickness of sand and gravel varies from place to place.	Poor in subsoil: plastic; moderate shrink-swell potential. Fair or good below depth of about 4½ feet.	Slope limitation slight for 148A, moderate for 148B and 148C2, severe for 148D2; highly porous material below depth of about 4½ feet; danger of ground water contamination.	Slope limitation slight for 148A and 148B, moderate for 148C2 and 148D2; highly porous material below depth of about 4½ feet; danger of ground water contamination.	Nearly level to strongly sloping; cuts deeper than 4½ feet expose sandy and gravelly material.
Radford: 74	Good in upper 26 inches: high fertility.	Unsuitable: fine-grained material.	Fair or poor: plastic below depth of about 2 feet.	Severe: subject to overflow.	Severe: subject to overflow; seasonal high water table.	Nearly level; subject to overflow.
Ross: 73	Good in upper 24 inches: high fertility.	Unsuitable: fine-grained material.	Fair or poor: not always accessible in bottom land.	Severe: subject to overflow.	Severe: subject to overflow.	Nearly level; subject to overflow.

See footnote at end of table.

interpretations—Continued

Soil features affecting—Continued							
Winter grading	Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
		Reservoir areas	Embankments				
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Low or moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Rapid permeability below depth of about 4 feet; excessive seepage is likely.	Fair or good stability and compaction; excessive seepage is likely with material taken below depth of 4 feet.	Naturally well drained and moderately well drained; moderately permeable.	Nearly level and sloping; high available water capacity; moderate water-intake rate; sloping areas subject to erosion.	Short slopes; exposed subsoil is silty clay loam; moderate in fertility.	Moderate fertility in exposed subsoil; high available water capacity; most soil features favorable.
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Highly permeable material below depth of about 4½ feet; excessive seepage is likely.	Fair or good stability and compaction; some seepage is likely with material taken below depth of about 4½ feet.	Naturally well drained and moderately well drained; moderate permeability.	High available water capacity; subject to erosion on sloping areas; level areas are well suited.	Short slopes; sand or gravel at depth of about 4½ feet; moderate fertility in exposed subsoil.	Moderate fertility in exposed subsoil; high available water capacity; sand or gravel below depth of about 4½ feet.
Seasonal high water table; subject to overflow.	Subject to overflow; moderate shrink-swell potential below depth of about 2 feet.	Seasonal high water table; more suitable for dugout ponds; subject to overflow.	Fair or good stability and compaction.	Naturally somewhat poorly drained; moderate permeability.	Nearly level; high available water capacity; moderate water-intake rate; subject to overflow.	([1])	([1]).
Difficult to break frozen clods and to compact the material.	Low shrink-swell potential; subject to overflow.	Subject to overflow.	Poor to good stability and compaction.	Naturally well drained; moderate permeability; subject to overflow.	Nearly level; high available water capacity; moderate permeability; moderate water-intake rate; subject to overflow.	([1])	([1]).

TABLE 8.—*Engineering*

Soil series and map symbol	Suitability as a source of—			Degree and kind of limitations affecting sewage disposal		Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Sewage lagoons	Septic tank filter fields	Highway location
Rushville: 16	Fair or good in upper 13 inches; moderate fertility.	Unsuitable: fine-grained material.	Poor in subsoil: highly plastic. Fair or poor below subsoil.	Slight: slow or very slow permeability.	Severe: slow or very slow permeability.	Depressional; seasonal high water table within 3 feet of surface.
Russell. Mapped only in a complex with Miami soils.	Fair or good in upper 8 inches: moderate fertility.	Unsuitable: fine-grained material.	Fair or poor: subsoil is plastic; moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Severe: slope 12 to 18 percent.	Severe: slope 12 to 18 percent.	Moderately steep slopes; cuts and fills needed.
Sable: 68	Fair in upper 20 inches: clayey, sticky when wet and cloddy when dry; high fertility.	Unsuitable: fine-grained material.	Poor: highly plastic in subsoil; moderate shrink-swell potential.	Moderate: moderate permeability.	Severe: seasonal high water table within 3 feet of surface.	Nearly level or depressional; seasonal high water table above depth of 3 feet; subject to ponding; susceptible to frost heave.
St. Charles: 243B, 243C2.	Fair or good in upper 7 inches: moderate fertility.	Good: stratified sand or gravel below depth of about 4 feet.	Poor in subsoil: subsoil is plastic. Fair or good below depth of about 4 feet.	Slope limitation moderate for 243B and 243C2; highly porous below depth of about 4 feet; danger of ground water contamination.	Slope limitation slight for 243B, moderate for 243C2; highly porous material below depth of about 4 feet; danger of ground water contamination.	Sloping; cuts and fills needed in some places.
Sawmill: 107,107+	Fair in upper 27 inches: clayey material is sticky when wet and cloddy and hard when dry; high fertility.	Unsuitable in most places: fine-grained material. In a few places, sand or gravel is below depth of 6 to 8 feet.	Poor: highly plastic.	Severe: subject to overflow.	Severe: subject to overflow; seasonal high water table.	Nearly level; subject to overflow.

See footnote at end of table.

interpretations—Continued

Soil features affecting—Continued							
Winter grading	Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
		Reservoir areas	Embankments				
Seasonal high water table.	High or moderate shrink-swell potential; seasonal high water table; excavations fill with water; basements and foundations are wet.	Seasonal high water table; more suitable for dug-out ponds.	Poor to good stability and compaction.	Naturally poorly drained and very poorly drained; slow or very slow permeability; subject to ponding.	Depressional; slow water-intake rate; high available water capacity; subject to ponding.	(1)	(1).
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Moderate permeability; most soil features are favorable.	Poor to good stability and compaction.	Naturally well drained; moderate permeability.	Sloping; high available water capacity; moderate water-intake rate; subject to erosion.	Slopes too steep; difficulty in construction.	Moderate fertility in exposed subsoil; moderately steep slopes; some difficulty in establishing and maintaining vegetation; high available water capacity.
Seasonal high water table.	Moderate shrink-swell potential; seasonal high water table; excavations fill with water; basements and foundations are wet.	Seasonal high water table; more suitable for dug-out ponds.	Poor to good stability and compaction.	Natural drainage is poor; moderate permeability; subject to ponding.	Nearly level and depressional; very high available water capacity; moderate water-intake rate.	(1)	(1).
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Moderate to moderately rapid permeability below depth of about 4 feet; excessive seepage is likely.	Fair or good stability and compaction; excessive seepage is likely with material taken below depth of about 4 feet.	Naturally well drained and moderately well drained; moderate permeability in subsoil.	Sloping; high available water capacity; moderate permeability; moderate water-intake rate; subject to water erosion.	Short and irregular slopes; exposed subsoil is clayey and moderate in fertility.	Moderate fertility in exposed subsoil; high available water capacity; most soil features favorable.
Seasonal high water table.	Subject to overflow; moderate shrink-swell potential.	Seasonal high water table; more suitable for dug-out ponds; subject to overflow.	Poor to good stability and compaction.	Naturally poorly drained; moderate to moderately slow permeability; subject to overflow.	Nearly level; very high available water capacity; moderate water-intake rate; subject to overflow.	(1)	(1).

TABLE 8.—*Engineering*

Soil series and map symbol	Suitability as a source of—			Degree and kind of limitations affecting sewage dsposal		Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Sewage lagoons	Septic tank filter fields	Highway location
Shiloh: 138	Fair in upper 32 inches: clayey material is sticky when wet, cloddy and hard when dry; high fertility.	Unsuitable: fine-grained material.	Poor: highly plastic.	Slight: slow or moderately slow permeability.	Severe: slow or moderately slow permeability; subject to ponding and overflow.	Depressional; seasonal high water table within 3 feet of surface; subject to ponding and overflow in some places.
Sylvan. Mapped only in an undifferentiated unit with Hickory soils.	Fair or good in upper 9 inches: moderate fertility.	Unsuitable: fine-grained material.	Fair to poor: subsoil is poor; plastic; moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Severe: slope too steep.	Severe: slope too steep.	Steep and very steep slopes; cuts and fills needed.
*Tallula: 965D2. For Bold part, see Bold series.	Good in upper 8 inches; high fertility.	Unsuitable: fine-grained material.	Fair: low shrink-swell potential; highly erodible.	Severe: slopes of 6 to 15 percent.	Moderate to severe: slopes of 6 to 15 percent; difficulty in construction and function with slope over about 12 percent.	Sloping topography; cuts and fill needed; highly erodible.
Tama: 36A, 36B, 36C2, 36D2.	Good in upper 13 inches for 36A, 36B, and upper 8 inches for 36C2, 36D2: high fertility.	Unsuitable for Tama soils on uplands: fine-grained material. Good below depth of about 5 feet for Tama soils on stream terraces.	Poor in subsoil: plastic; moderate shrink-swell potential.	Slope limitation slight for 36A, moderate for 36B and 36C2, severe for 36D2; Tama soils on stream terraces have highly porous material below depth of about 5 feet.	Slope limitation slight for 36A and 36B, moderate for 36C2 and 36D2; Tama soils on stream terraces have highly porous material below depth of about 5 feet.	Nearly level to strongly sloping; cuts and fill needed; well drained.

See footnote at end of table.

interpretations—Continued

Soil features affecting—Continued							
Winter grading	Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
		Reservoir areas	Embankments				
Seasonal high water table; subject to ponding and overflow in some places.	High shrink-swell potential; seasonal high water table; excavations fill with water; basements and foundations are wet.	Seasonal high water table; more suitable for dug-out ponds; subject to overflow in some places.	Poor to good stability and compaction.	Naturally very poorly drained; slow or moderately slow permeability; subject to ponding and overflow.	Depressional; high available water capacity; slow or moderately slow permeability; slow water-intake rate.	(1)	(1).
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Steep and very steep slopes cause construction difficulties.	Moderate permeability; most soil features are favorable.	Poor to good stability and compaction.	Naturally well drained; moderate permeability.	Slopes too steep.	(1)	(1).
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Low shrink-swell potential.	Moderately rapid permeability below depth of about 2½ feet.	Poor stability and compaction.	Naturally well drained and moderately well drained; moderate permeability in subsoil.	Sloping; high available water capacity; moderate water-intake rate; subject to erosion.	Short irregular slopes; exposed subsoil is moderate in fertility; highly erodible.	Moderate fertility in exposed subsoil; high available water capacity; highly erodible.
Soils plastic when wet; difficult to break frozen clods and to compact the material.	Moderate shrink-swell potential in subsoil and low shrink-swell potential below subsoil.	Moderate permeability; most soil features favorable for Tama soils on uplands; Tama soils on stream terraces have highly permeable material below depth of about 5 feet.	Fair or good stability and compaction.	Naturally well drained; moderate permeability.	Nearly level and sloping; very high available water capacity; moderate water-intake rate.	Short and irregular slopes; exposed subsoil is clayey; moderate fertility.	Moderate fertility in exposed subsoil; very high available water capacity; most soil features favorable.

TABLE 8.—*Engineering*

Soil series and map symbol	Suitability as a source of—			Degree and kind of limitations affecting sewage disposal		Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Sewage lagoons	Septic tank filter fields	Highway location
Thebes: 212C2, 212D3, 212E2.	Fair or good in upper 5 inches: moderate fertility.	Fair for sand below depth of about 3 feet; extent of sand varies from place to place; contains some fines in places.	Poor in subsoil; good or fair below subsoil if confined or if soil binder is added.	Severe: highly permeable material at a depth of about 3 feet; danger of ground water contamination.	Slope limitation moderate for 212C2 and 212D3, severe for 212E2: moderate permeability in subsoil; however, highly porous material below depth of about 3 feet; danger of ground water contamination.	Sloping topography; cuts and fills needed; erodible sand below depth of about 3 feet.
Tice: 284	Fair in upper 14 inches: clayey material is sticky when wet and cloddy and hard when dry; high fertility.	Unsuitable: fine-grained material.	Poor: highly plastic.	Severe: subject to overflow.	Severe: subject to overflow; seasonal high water table.	Nearly level; subject to overflow.

[1] Practice not applicable on this soil.

Engineering classification systems

Engineers commonly classify soils according to the Unified Soil Classification System (*10*) and the system adopted by the American Association of State Highway Officials (AASHO) (*1*).

The Unified system of soil classification is based on the identification of soils according to particle size and distribution, plasticity, liquid limit, and organic-matter content. In this system, SM and SC are sands with nonplastic or plastic fines; GC are gravelly soils with plastic fines; ML and CL are nonplastic or plastic, fine-grained materials with low liquid limit; MH and CH are primarily nonplastic or plastic, fine-grained materials with a high liquid limit.

The AASHO system is used to classify soils according to those properties that affect their use in highway construction. Soils of about the same general load-carrying capacity and service are placed into twelve basic groups and subgroups, A–1 to A–7. Generally, the best soils for road subgrade are classified A–1, the next best A–2, and the poorest soils are A–7.

Agricultural scientists classify soils by texture according to the system of the United States Department of Agriculture (*8*). Soil material smaller than 2.0 mm. in diameter is classified in three size fractions, as clay, silt, or sand. The percentages of the three size fractions determine the texture.

Estimated engineering properties

Table 7 gives the estimated soil properties most likely to affect engineering practices. The information in this table is based on properties of typical soils in the survey area and on other available data.

Depth to bedrock is not estimated in table 7, because most soils in the survey area are deep enough that bedrock generally does not affect their use. Depth to bedrock for all of the soils in Logan County is well below the 5-foot depths to which soils were investigated in field mapping. However, borings 12 to 14 feet deep were made throughout the county to determine the thickness of loess and, in some places, the thickness of underlying sand. These borings were made for the most part in nearly level to gently sloping areas, and no bedrock was encountered. There is limestone exposed along Salt Creek at Rocky Ford in sections 6 and 7 of Broadwell Township. A limestone quarry is at this site. During the course of field mapping, exposures of shale were noted on upland slopes facing Salt Creek bottom land in sections 33 and 34 of West Lincoln Township. Other exposures were noted in section 18 of Broadwell and section 24 of Corwin Township.

Depth to seasonal high water table is the minimum depth

interpretations—Continued

Soil features affecting—Continued							
Winter	Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
		Reservoir areas	Embankments				
Soils plastic above depth of about 3 feet; difficult to break frozen clods and to compact the material; loose sand below depth of about 3 feet; traction difficult.	Moderate shrink-swell potential in subsoil; low shrink-swell potential below subsoil.	Rapid permeability below depth of about 3 feet; sandy; excessive seepage is likely.	Fair or good stability and compaction; excessive seepage is likely with material taken below depth of about 3 feet.	Naturally well drained and moderately well drained; moderate permeability.	Sloping; moderate available water capacity; subject to erosion.	Short and irregular slopes; exposed subsoil is clayey; deep cuts expose sand that is droughty; low fertility.	Moderate fertility in exposed subsoil; moderate available water capacity; deep cuts expose sand that is droughty; low fertility.
Seasonal high water table.	Subject to overflow; moderate shrink-swell potential.	Seasonal high water table; more suitable for dug-out ponds; subject to overflow.	Poor to good stability and compaction.	Naturally somewhat poorly drained; moderate permeability; subject to overflow.	Nearly level; high available water capacity; moderate water-intake rate; subject to overflow.	(1) ----------	(1).

at which the soil is periodically saturated or contains free water, unless drainage systems have been installed. It may be a perched water table or the upper limit of the true water table. Where the water table is very near the surface, it commonly interferes with timely and efficient use and management of the soil. It generally rises late in winter and early in spring.

Permeability of a soil, as used in this survey, is its ability to transmit water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on the structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soil are not considered. Ratings of permeability in inches per hour are *very slow*, less than 0.063; *slow*, less than 0.20; *moderately slow*, 0.20 to 0.63; *moderate*, 0.63 to 2.00; *moderately rapid*, 2.00 to 6.3; *rapid*, 6.3.

Available water capacity is the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. In table 7 it is expressed as inches of water per inch of soil.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH indicates the corrosiveness of the soil solution and the degree of protection required for pipelines placed in the soil. Reaction is also used to estimate the suitability of certain plants for planting along highways. The pH value and related terms used to describe soil reaction are defined in the Glossary.

Shrink-swell potential indicates the volume change to be expected of a soil when the moisture content changes. The shrink-swell potential generally is high in very clayey soils and low in very sandy soils. Generally a high shrink-swell potential indicates that the soil material is hazardous to use for engineering structures.

Some soils tend to cause corrosion of concrete conduits. The ratings in table 7 are only estimates of expected corrosivity. Extensive installations that cross soil boundaries or horizons are more likely to be damaged by corrosion than are installations placed entirely in one kind of soil. Because conduits normally are not placed in the surface layer, ratings are not given for that layer.

Engineering interpretations

Table 8 gives the suitability of soil material for certain uses and describes specific characteristics of each soil series that affect the design and application of construction measures. Some of the hazards and problems related to construction and maintenance are given in the table.

Soils that are rated poor or fair as a source of topsoil are low or moderate in natural fertility, or are clayey and sticky and difficult to handle or work.

Soils rated good as a source of sand and gravel (fig. 21) need further investigation to find the material that a specific user requires.

Ratings of the suitability of soils as a source of road fill are based on the performance of the soil material when excavated and used as borrow for highway subgrade. In general a sandy material containing adequate binder is the best. It is the least affected by adverse weather conditions and can be worked during a greater number of months of the year. The poorest materials are plastic clays.

In considering those features and qualities of the soil that affect its performance of the soil for the location of highways, the entire undisturbed soil profile without artificial drainage is evaluated. It is assumed that the surface layer, because of its higher organic-matter content, will be removed and used for topsoil.

The suitability of the soils for winter grading depends upon the ease with which the soil can be moved by ordinary construction equipment during the winter months.

The factors considered in foundations for low buildings are those properties and qualities of undisturbed soils that affect their suitability for supporting buildings less than three stories high.

Where the soil limitations for sewage disposal change among mapping units of the same series, a rating is given for each; otherwise, the rating is for all mapping units in the series. A slight limitation for sewage lagoons indicates no unfavorable condition. The conditions that cause the limitations to be rated moderate or severe are indicated. A slight limitation of the soils for use as septic tank filter fields is not rated as an unfavorable feature. The conditions that cause the limitations to be rated as moderate or severe are indicated.

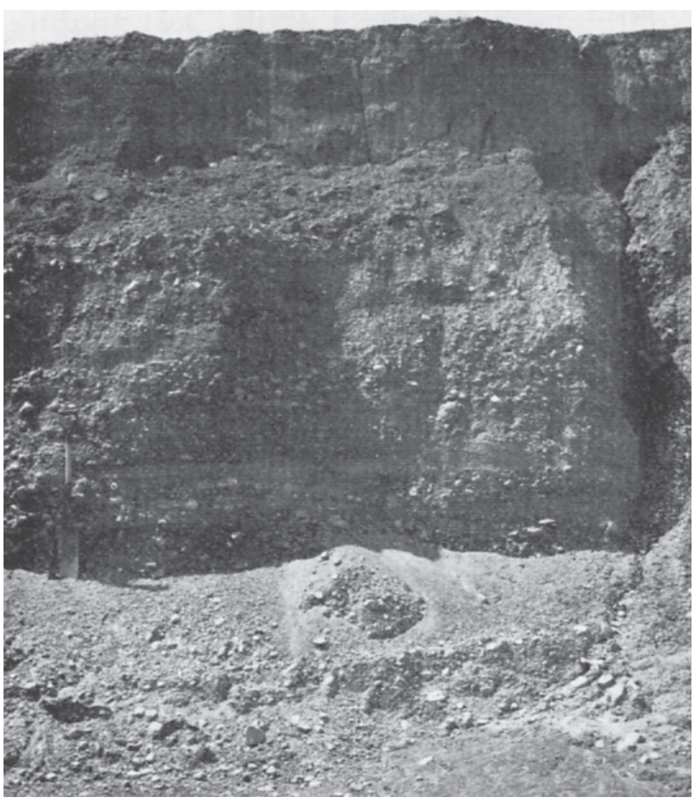

Figure 21.—**Sand and gravel that underlie soils on stream terraces. Spade is 4 feet long.**

Soil features affecting the reservoir area of farm ponds are those of undisturbed soils that affect their suitability for reservoirs (fig. 22).

Considered for the embankment of farm ponds are those features and qualities of soils that affect their suitability for constructing pond embankments.

The factors considered in agricultural drainage are the characteristics and qualities of those soils that require drainage. These factors affect the installation and performance of surface and subsurface drainage practices.

Among the soil features that affect irrigation, topography is less critical where sprinkler irrigation is used than it is where a gravitational method is used.

Among the factors that affect terraces and diversions and grassed waterways are those that affect the establishment, growth, and maintenance of vegetative cover (fig. 23). Also listed are factors that hinder layout and construction.

Formation, Morphology, and Classification of Soils

This section discusses the factors affecting the formation of Logan County soils, briefly describes the horizon nomenclature and the processes involved in horizon development, and briefly explains the current system of classification based on natural characteristics of soils.

Factors of Soil Formation

Soil is formed by the action of soil-forming processes on material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by: (1) the physical and mineralogical composition of the parent material; (2) the plant and animal life on and in the soil; (3) the topography or lay of the land; (4) the climate under which the soil material has accumulated and existed since accumulation; and (5) the length of time the forces of soil development have acted on the soil material.

Parent material

Parent material is the unconsolidated mass in which the soils have formed. It determines the mineralogical and chemical composition of the soil and to a large extent the rate that soil-forming processes take place.

The soils of Logan County have formed in loess, eolian sand, alluvium, glacial outwash, and glacial till. Loess is by far the most important parent material because it blankets most of the other materials. The loess, termed Peorian, is gray and yellowish-brown, calcareous silt loam.

Thickness of the Peorian loess in nearly level upland areas ranges from 10 to 12 feet. It is less on steeper slopes. The more extensive soils, such as the Ipava, Sable, and Tama, have a solum that formed entirely in loess. In areas where the loess is thinner, such soils as the Catlin and Birkbeck have a solum that formed in loess and the underlying glacial till. It is only on steep slopes or in isolated spots, where erosion removed loess faster than it was being deposited, that there are soils formed almost entirely in glacial till of Wisconsinan age or Illinoian age.

***Figure 22.*—Farm pond that provides recreation, helps to control gullying, and serves as a source of water. Side slopes are Hickory and Sylvan soils.**

There are many areas in the county that have a layer of windblown sand in the loess. The sand layer is commonly at a depth below 40 inches, but it is shallower in some places. It ranges in thickness from a few inches to several feet. The soils in these areas have a solum that formed in loess and the underlying sand. Broadwell, Lawndale, and Middletown soils are examples.

In some places there are areas of sand. Soils that occupy only relatively small acreage formed in this sandy material because the sand is covered by loess in most places. An example of these soils is Dickinson-Onarga sandy loams.

In Logan County the stream valleys contain glacial outwash deposits in the form of terraces. These terraces are made up mostly of sand and gravel, but they are covered with a rather thick layer of loess or silty water-deposited material. Some of the soils in these areas have all of the solum formed in the silty overburden. Tama soils are examples. Other soils have the lower solum formed in the underlying sand and gravel. Plano and Ellburn soils are examples. In some places the loess or silty water-deposited material is thinner and the soils have more of their solum formed in the coarser textured outwash. Brenton and Proctor soils are examples.

Soils on bottom land in the county formed in rather recent, geologically speaking, water-laid materials or alluvium coming from eroding soils on uplands. Many of these soils are still receiving sediments. The texture of these materials ranges from silt loam to silty clay loam. Examples of these soils are Sawmill and Lawson.

Till of the Illinoian age and Wisconsinan age is found in the county. The Wisconsinan till occupies the northeastern corner of the county, and the Illinoian till occupies the rest of the county. The number of soils developed entirely in these tills is small because of the loess cover. Those soils that formed in till occupy the steeper areas along the creeks or isolated areas where the loess is thin. Hennepin, Miami, and Hickory soils are examples.

Plant and animal life

All living organisms, such as vegetation, animals, bacteria, and fungi, are important to soil formation. Vegetation is generally responsible for the amount of organic matter, the color of the surface layer, and the amount of

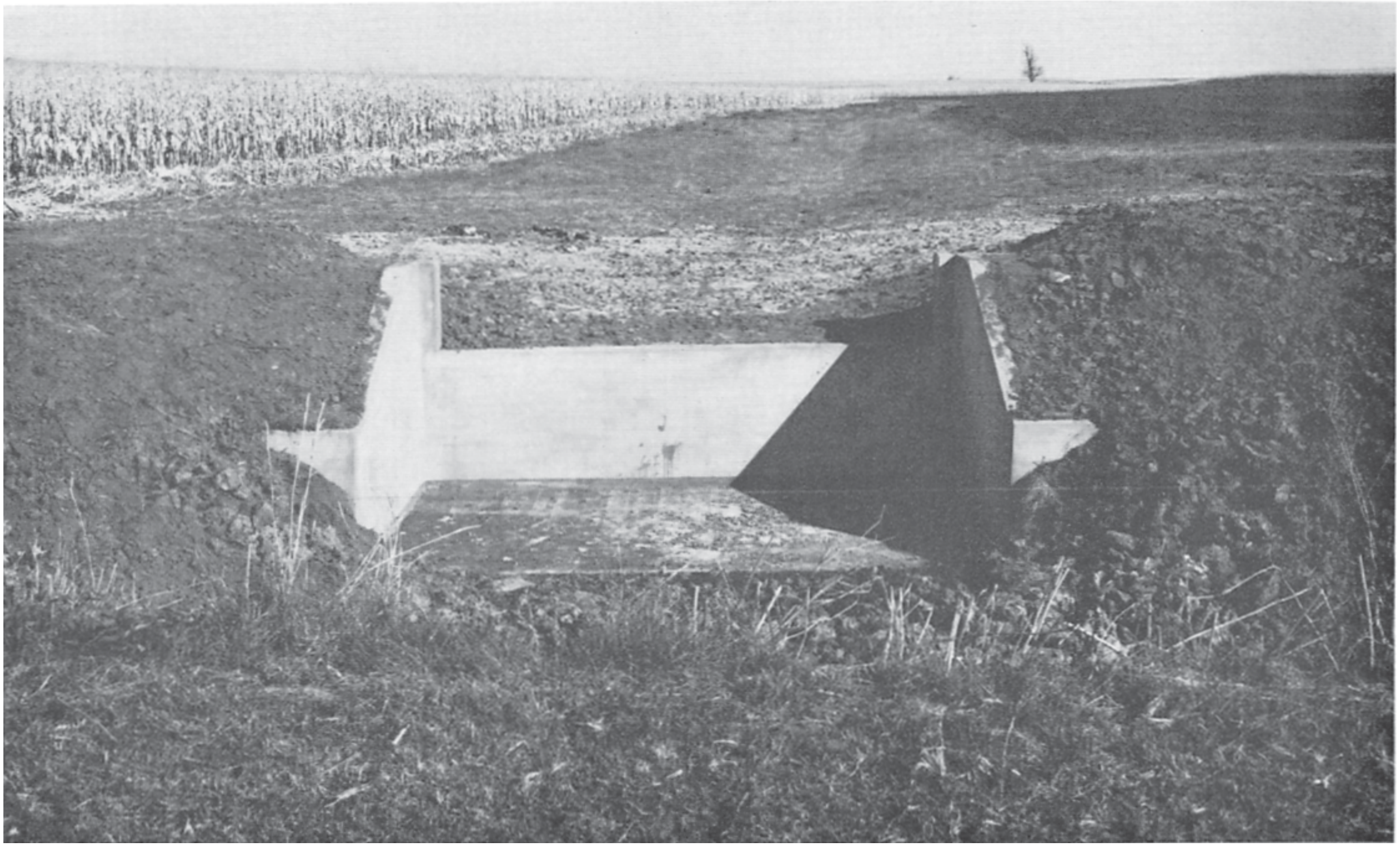

***Figure 23.*—Straight-drop spillway constructed to stabilize and control the grade of a grassed waterway.**

nutrients. Animals, such as earthworms, cicadas, and burrowing animals, help to keep the soil open and porous. Bacteria and fungi decompose the vegetation and help to release nutrients for plant food.

The influence of vegetation has been fairly uniform over the county. Bluestem prairie dominated the landscape, and hardwood forest occupied the bottom lands and steeper slopes along the streams. The influence of plant and animal life caused the soils formed under prairie grasses to be dark colored and to have a high organic-matter content and granular surface layer. On the other hand, those soils that developed under trees have a lighter colored surface layer, are more acid and less fertile, and have a lower organic-matter content. Soils of the bottom lands are thick and dark colored, mainly because the water-laid material is dark colored.

In many places erosion has destroyed the effects of the native vegetation. For all practical purposes, man has stopped the effect of native vegetation upon the soil. Henceforth, the effects of vegetation will be the result of man's cultivation practices.

Topography

Many differences in soils of the county are caused by topography. Slope or lay of the land affects drainage, runoff, erosion, and deposition. Slopes differ in gradient, length, shape, and exposure.

Some or all of these slope characteristics are responsible for the differences among soils that are derived from similar parent materials, such as Ipava, Sable, and Tama soils. Similar topography in different parent materials has resulted in soils that have comparable characteristics. As examples, Drummer and Sable soils formed in different parent materials but have similar natural drainage characteristics.

As the steepness of the slope increases, runoff becomes greater; the result is that less water penetrates the soil and the soils formed are thin. An example is Hennepin soils. When steepness of slope increases, runoff is greater and the ensuing erosion constantly changes characteristics of soils. An example is a comparison between eroded and uneroded soils of the Clinton series. Where slope is nearly level or depressional and excess water has been able to move through the parent material, soils with a high clay content in the subsoil have formed. Denny soils are an example.

Climate

Logan County has a continental climate that is marked by extreme seasonal temperature changes. Summers are hot and humid; winters are cold and humid. Climate in the county has been uniform during formation of the soils. Because of this uniformity, none of the soils reflects characteristics caused entirely by climatic differences within the county.

Climate, however, is important in soil formation because it influences the variety of plants and also largely determines the type of weathering that takes place. Actually the humid, temperate climate of Logan County is more suited to trees than to grasses, but prairie grasses still persisted in the county until the time of settlement. Well-distributed rainfall, prairie vegetation, and freezing temperatures during part of the year have promoted the accumulation of organic matter and dark colors in the surface layer of many of the soils. The few soils in Logan County that formed under trees do not have a high organic-matter content and are lighter colored. The by-products resulting from the decay of forest litter are not ideal for the accumulation of organic matter. Precipitation in Logan County is sufficient to leach free carbonates from most of the soils. The dark-colored soils are less acid than the light-colored soils. For more detailed information on climate, refer to the section "General Nature of the County."

Time

The formation of soils requires time. Changes take place slowly in the parent materials. If measured in years, it is a long time. But the age of soils is determined by the degree of soil development in a soil profile. Those with little or no soil development are immature. Those having well-expressed soil horizons are mature, even though the parent materials in which they formed are the same age.

Lawson soils of the bottom lands are examples of very young soils. These soils have been modified very little by the factors of soil formation.

Denny soils, on the other hand, have been greatly modified. These soils have formed distinct horizons. Their subsoil is very high in clay content and bears little resemblance to the material from which it has formed.

Tama soils are intermediate in maturity between the immature Lawson and the more mature Denny soils.

Morphology of Soils

This subsection briefly describes the horizon nomenclature and the processes involved in horizon development.

Major soil horizons.—The results of the soil-forming factors can be distinguished by the different layers, or soil horizons, seen in a soil profile. The soil profile extends from the surface of the soil downward to materials that are little altered by the soil-forming processes.

Most soils contain three major horizons, called the A, B, and C. These major horizons can be further subdivided by the use of subscripts and letters to indicate changes within one horizon. An example is the B2t horizon, which is a layer within the B horizon that contains translocated clay illuviated from the A horizon.

The A horizon is the surface layer. It is the layer with the largest accumulation of organic matter, called an A1 horizon. It is also the layer of maximum leaching, or eluviation, of clay and iron. When considerable leaching has taken place, an A2 horizon is formed.

The B horizon lies underneath the A horizon and is commonly called the subsoil. It is the horizon of maximum accumulation, or illuviation, of clay or iron leached from the A horizon. The B horizon is generally firmer, has a blocky or prismatic structure, and is generally lighter colored than the A horizon but darker than the C horizon. Most young soils have not formed a B horizon.

The C horizon is below the B horizon. It consists of materials that are little altered by the soil-forming processes but are modified by weathering. In Logan County the horizon immediately below the B horizon is not the same for all soils. For example, Ipava soils have silt loam (loess) below their B horizon. Broadwell soils have sand and Birkbeck soils have loam (glacial till) underlying their B horizon.

Processes of soil horizon differentiation.—There are several processes involved in the formation of soil horizons in the soils of Logan County. These include the accumulation of organic matter, the leaching of lime carbonates, the formation and translocation of clay minerals, and reduction and transfer of iron. These processes are very slow and take hundreds of thousands of years to reach equilibrium with the environment.

The accumulation of organic matter takes place with the decomposition of plant residue. This process darkens the surface layer and helps to form the A1 horizon. It takes a long time for organic matter to accumulate. Most of the Logan County soils have high organic-matter content, but there are a few that are low in organic-matter content.

For soils to have distinct soil horizons, lime and other soluble salts must be leached before the translocation of clay minerals. Temperature, rainfall, and topography are some of the factors that affect leaching. Soils that are frozen part of the year are not as rapidly leached as those soils that are never frozen, other factors being the same. The amount of rainfall determines the amount of water that will move through the soil and the depth to which the soil solution can penetrate. The amount of water that moves through the soil depends partly on topography. More water runs off steep slopes, as a rule, than off gentle slopes. Soils that have a high water table are less likely to be leached as deeply as soils that have a lower water table.

The most important process of soil-horizon formation in Logan County is the formation and translocation of silicate clay minerals. The amount of clay minerals in a soil profile depends upon the parent materials, but clay amounts range from one soil horizon to another. Clay minerals are generally eluviated (removed) from the A horizon and illuviated (accumulated) in the B horizon as clay films on the ped surfaces and in the pores and root channels. In some soils an A2 horizon has been formed by considerable eluviation of clay minerals to the B horizon. The A2 horizon is gray colored and has platy structure. Keomah soils are an example of soils that show the translocation of clay minerals.

The reduction and transfer of iron is associated mainly with the wetter, more poorly drained soils. This process is called gleying. Moderately well drained and somewhat poorly drained soils have yellowish-brown mottles that indicate the segregation of iron. Poorly drained to very poorly drained soils have a grayish subsoil and underlying material, which indicates the reduction and transfer of iron. Sable, Shiloh, and Sawmill soils are among those that have profiles indicating reduction and transfer of iron.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us understand their behavior and their response to manipulation. First through classification, and then through the use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system currently used in classifying soils was adopted for general use by the National Cooperative Soil Survey in 1965 and supplemented in March 1967, September 1968, and April 1969 (*9*). This system is under continual study, and readers interested in the development of the system should refer to the latest literature available (*7*).

Table 9 shows the classification of each of the soil series represented in the county according to the present system. Some of the soils do not fit in a series that has been recognized in the classification system, but recognition of a separate series would not serve a useful purpose. Such

TABLE 9.—*Classification of soils*

Series	Family	Subgroup	Order
Alvin	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Birkbeck	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Bold	Coarse-silty, mixed, calcareous, mesic	Typic Udorthents	Entisols.
Brenton	Fine-silty, mixed, mesic	Aquic Argiudolls	Mollisols.
Broadwell [1]	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Brooklyn	Fine, montmorillonitic, mesic	Mollic Albaqualfs	Alfisols.
Catlin [2]	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Clarksdale	Fine, montmorillonitic, mesic	Udollic Ochraqualfs	Alfisols.
Clinton [3]	Fine, montmorillonitic, mesic	Typic Hapludalfs	Alfisols.
Denny	Fine, montmorillonitic, mesic	Mollic Albaqualfs	Alfisols.
Dickinson [1]	Coarse-loamy, mixed, mesic	Typic Hapludolls	Mollisols.
Drummer	Fine-silty, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
Elburn	Fine-silty, mixed, mesic	Aquic Argiudolls	Mollisols.
Elkhart	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Fayette	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Harpster	Fine-silty, mixed, mesic	Typic Calciaquolls	Mollisols.
Hartsburg	Fine-silty, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
Hennepin	Fine-loamy, mixed, mesic	Typic Eutrochrepts	Inceptisols.
Hickory	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Huntsville	Fine-silty, mixed, mesic	Cumulic Hapludolls	Mollisols.
Ipava	Fine, montmorillonitic, mesic	Aquic Argiudolls	Mollisols.
Keomah	Fine, montmorillonitic, mesic	Aeric Ochraqualfs	Alfisols.
Knight	Fine-silty, mixed, mesic	Argiaquic Argialbolls	Mollisols.
Lamont	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Lawndale	Fine-silty, mixed, mesic	Aquic Argiudolls	Mollisols.
Lawson	Fine-silty, mixed, mesic	Cumulic (Aquic Cumulic) Hapludolls	Mollisols.
Miami	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Middletown	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Muscatine	Fine-silty, mixed, mesic	Aquic Argiudolls	Mollisols.
Onarga [1]	Coarse-loamy (fine-loamy), mixed, mesic	Typic Argiudolls	Mollisols.
Parr [2]	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Pillot [4]	Fine-silty over sandy or sandy-skeletal, mixed, mesic.	Typic Argiudolls	Mollisols.
Plano [1]	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Proctor [5]	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Radford	Fine-silty, mixed, mesic	Fluventic (Aquic Fluventic) Hapludolls.	Mollisols.
Ross	Fine-loamy, mixed, mesic	Cumulic Hapludolls	Mollisols.
Rushville	Fine-montmorillonitic, mesic	Typic Albaqualfs	Alfisols.
Russell	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Sable	Fine-silty, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
St. Charles	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Sawmill	Fine-silty, mixed, noncalcareous, mesic	Cumulic Haplaquolls	Mollisols.
Shiloh	Fine, montmorillonitic, noncalcareous, mesic	Cumulic Haplaquolls	Mollisols.
Sylvan	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Tallula	Coarse-silty, mixed, mesic	Typic (Entic) Hapludolls	Mollisols.
Tama [1]	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Thebes	Fine-silty over sandy or sandy-skeletal, mixed, mesic	Typic Hapludalfs	Alfisols.
Tice	Fine-silty, mixed, mesic	Aquic Fluventic Hapludolls	Mollisols.

[1] Some of these soils are taxadjuncts because the combined thickness of the Ap and A1 horizons is less than the range defined for the series.

[2] Some of these soils are taxadjuncts because the thickness of the A horizon is less than the range defined for the series.

[3] Some of these soils are taxadjuncts because the B horizon contains less clay than the range defined for the Clinton series.

[4] Some of these soils are taxadjuncts because the combined thickness of the Ap, A1, and A3 horizons is less than that defined for the Pillot series.

[5] Some of these soils are taxadjuncts because the combined thickness of the Ap and A3 horizons and the thickness of the B horizon are less than the range defined for the Proctor series.

soils are named for the series they strongly resemble because they differ from those series in ways too small to be of consequence in interpreting their usefulness or behavior. Soil scientists designate such soils as taxadjuncts to the series for which they are named. In this survey, eroded soils named in the Broadwell, Catlin, Dickinson, Onarga, Parr, Pillot, Plano, Proctor, and Tama series are taxadjuncts to those series.

The current system defines classes in terms of observable or measurable properties of soils. The properties chosen are primarily those that permit the grouping of soils that are similar in genesis. The classification is designed to encompass all soils. It has six categories. Beginning with the most inclusive, they are the order, the suborder, the great group, the subgroup, the family, and the series. These are briefly defined in the following paragraphs.

ORDER.—Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, the Entisols and Histosols, are in many different climates. The four orders represented in Logan County are Inceptisols, Mollisols, Alfisols, and Entisols.

Inceptisols generally develop on young, but not recent, land surfaces. Mollisols usually develop under grass vegetation. They have a thick, dark-colored surface layer called the mollic epipedon. Alfisols are soils that have clay-enriched B horizons that are high in base saturation. Entisols are recent mineral soils that do not have genetic horizons or have only the beginnings of such horizons.

SUBORDER.—Each order is subdivided into suborders, primarily on the basis of characteristics that seem to produce classes having genetic similarity. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The climatic range is narrower than that of the orders.

GREAT GROUP.—Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and other features. The horizons used as a basis for distinguishing between great groups are those in which clay, iron, or humus have accumulated or those that have pans that interfere with growth of roots or movement of water. The features used are the self-mulching properties of clays, soil temperature, chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like.

SUBGROUP.—Great groups are subdivided into subgroups. One represents the central (typic) segment of the group and others, called intergrades, have properties of one great group and also have one or more properties of another great group, suborder, or order. Subgroups may also be made in instances where soil properties intergrade outside the range of any other great group, suborder, or order.

FAMILY.—Families are established within a subgroup primarily on the basis of properties that affect the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

SERIES.—The series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile.

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Glossary

Acidity. See Reaction, soil.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

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

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time. They commonly have mottlings in the B and C horizons and in the lower part of the A horizon in some soils.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Glacial outwash. Cross-bedded gravel, sand, and silt deposited by melt water as it flowed from glacial ice.

Glacial till. Unassorted, unstratified glacial drift consisting of clay, silt, sand, gravel, and boulders transported and deposited by glacial ice.

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

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Percent slope. The slant or gradient of a slope stated in percent; for example, a slope of 10 percent is one that changes 10 feet of elevation for each 100 feet horizontal distance.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

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 a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Site index. A numerical means of expressing the quality of a forest site that is based on the height of the dominant stand at an arbitrarily chosen age; for example, the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. As used in this survey, generally a distinct grayish layer below a dark surface layer and above the subsoil and labeled as an A2 horizon in technical soil profile descriptions.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

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GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a management group, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 4, p. 13.
Predicted yields, table 5, p. 58.
Recreational interpretations, table 6, p. 60.
Engineering uses of the soils, tables 7 and 8, pp. 62 through 91.

Map symbol	Mapping unit	Described on page	Management group Symbol	Management group Page	Recreational group Number
16	Rushville silt loam	41	IIw-3	53	1
17	Keomah silt loam	31	IIw-4	54	2
18A	Clinton silt loam, 0 to 2 percent slopes	21	I-1	50	3
18B	Clinton silt loam, 2 to 4 percent slopes	21	IIe-1	51	3
18C2	Clinton silt loam, 4 to 7 percent slopes, eroded	21	IIe-1	51	3
18D2	Clinton silt loam, 7 to 12 percent slopes, eroded	21	IIIe-1	55	4
18D3	Clinton soils, 7 to 12 percent slopes, severely eroded	22	IVe-1	56	4
18E2	Clinton silt loam, 12 to 18 percent slopes, eroded	22	IVe-1	56	6
36A	Tama silt loam, 0 to 2 percent slopes	47	I-2	50	3
36B	Tama silt loam, 2 to 4 percent slopes	47	IIe-2	51	3
36C2	Tama silt loam, 4 to 7 percent slopes, eroded	47	IIe-2	51	3
36D2	Tama silt loam, 7 to 12 percent slopes, eroded	47	IIIe-2	55	4
41	Muscatine silt loam	36	I-4	51	2
43	Ipava silt loam	30	I-4	51	2
45	Denny silt loam	23	IIw-3	53	1
67	Harpster silty clay loam	27	IIw-1	52	1
68	Sable silty clay loam	43	IIw-1	52	1
73	Ross loam	41	I-3	51	5
74	Radford silt loam	40	I-5	51	5
77	Huntsville silt loam	30	I-3	51	5
107	Sawmill silty clay loam	44	IIw-2	53	1
107+	Sawmill silt loam, overwash	44	IIw-2	53	1
136	Brooklyn silt loam	18	IIw-3	53	1
138	Shiloh silty clay loam	45	IIw-1	52	1
148A	Proctor silt loam, 0 to 2 percent slopes	39	I-2	50	3
148B	Proctor silt loam, 2 to 4 percent slopes	40	IIe-2	51	3
148C2	Proctor silt loam, 4 to 7 percent slopes, eroded	40	IIe-2	51	3
148D2	Proctor silt loam, 7 to 12 percent slopes, eroded	40	IIIe-2	55	4
149	Brenton silt loam	16	I-4	51	2
152	Drummer silty clay loam	25	IIw-1	52	1
159B	Pillot silt loam, 1 to 4 percent slopes	38	IIe-2	51	3
159C2	Pillot silt loam, 4 to 10 percent slopes, eroded	38	IIIe-3	55	3
171B	Catlin silt loam, 2 to 4 percent slopes	19	IIe-2	51	3
171C2	Catlin silt loam, 4 to 7 percent slopes, eroded	19	IIe-2	51	3
171D2	Catlin silt loam, 7 to 12 percent slopes, eroded	19	IIIe-2	55	4
191	Knight silt loam	32	IIw-3	53	1
198	Elburn silt loam	25	I-4	51	2
199A	Plano silt loam, 0 to 2 percent slopes	38	I-2	50	3
199B	Plano silt loam, 2 to 4 percent slopes	39	IIe-2	51	3
199C2	Plano silt loam, 4 to 7 percent slopes, eroded	39	IIe-2	51	3
212C2	Thebes silt loam, 3 to 7 percent slopes, eroded	48	IIIe-3	55	3
212D3	Thebes soils, 7 to 12 percent slopes, severely eroded	48	IVe-1	56	4
212E2	Thebes silt loam, 12 to 35 percent slopes, eroded	48	VIe-1	56	6
221C2	Parr silt loam, 4 to 7 percent slopes, eroded	37	IIe-2	51	3
221D2	Parr silt loam, 7 to 18 percent slopes, eroded	37	IIIe-2	55	4
233B	Birkbeck silt loam, 2 to 4 percent slopes	15	IIe-1	51	3
233C2	Birkbeck silt loam, 4 to 7 percent slopes, eroded	15	IIe-1	51	3
243B	St. Charles silt loam, 1 to 4 percent slopes	44	IIe-1	51	3
243C2	St. Charles silt loam, 4 to 7 percent slopes, eroded	44	IIe-1	51	3
244	Hartsburg silty clay loam	28	IIw-1	52	1
257	Clarksdale silt loam	20	I-4	51	2
280	Fayette silt loam	27	I-1	50	3

Map symbol	Mapping unit	Described on page	Management group		Recreational group
			Symbol	Page	Number
284	Tice silty clay loam	49	I-5	51	5
451	Lawson silt loam	34	I-5	51	5
567C2	Elkhart silt loam, 4 to 7 percent slopes, eroded	26	IIe-2	51	3
567D2	Elkhart silt loam, 7 to 12 percent slopes, eroded	26	IIIe-2	55	4
683	Lawndale silt loam	33	I-4	51	2
684A	Broadwell silt loam, 0 to 2 percent slopes	17	I-2	50	3
684B	Broadwell silt loam, 2 to 4 percent slopes	17	IIe-2	51	3
684C2	Broadwell silt loam, 4 to 7 percent slopes, eroded	17	IIe-2	51	3
684D2	Broadwell silt loam, 7 to 12 percent slopes, eroded	18	IIIe-2	55	4
685B	Middletown silt loam, 1 to 4 percent slopes	35	IIe-1	51	3
685C2	Middletown silt loam, 4 to 7 percent slopes, eroded	35	IIe-1	51	3
685D2	Middletown silt loam, 7 to 15 percent slopes, eroded	35	IIIe-1	55	4
963F2	Hickory and Sylvan soils, 15 to 50 percent slopes, eroded	29	VIIe-1	57	6
964F	Hennepin and Miami soils, 18 to 60 percent slopes	29	VIIe-1	57	6
965D2	Tallula-Bold silt loams, 6 to 15 percent slopes, eroded	46	IIIe-2	55	4
966E2	Miami-Russell silt loams, 12 to 18 percent slopes, eroded	34	IVe-1	56	6
968D2	Birkbeck-Miami silt loams, 7 to 12 percent slopes, eroded	15	IIIe-1	55	4
968D3	Birkbeck-Miami complex, 7 to 12 percent slopes, severely eroded	15	IVe-1	56	4
974A	Dickinson-Onarga sandy loams, 0 to 2 percent slopes	24	IIs-1	55	3
974B	Dickinson-Onarga sandy loams, 2 to 7 percent slopes	24	IIIe-3	55	3
974C2	Dickinson-Onarga sandy loams, 2 to 7 percent slopes, eroded	24	IIIe-3	55	3
974D2	Dickinson-Onarga sandy loams, 7 to 15 percent slopes, eroded	24	IIIe-3	55	4
975C2	Alvin-Lamont sandy loams, 2 to 6 percent slopes, eroded	14	IIIe-3	55	3
975D2	Alvin-Lamont sandy loams, 7 to 12 percent slopes, eroded	14	IIIe-3	55	4
975E	Alvin-Lamont sandy loams, 12 to 30 percent slopes	14	VIe-1	56	6

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