United States
Department of
Agriculture

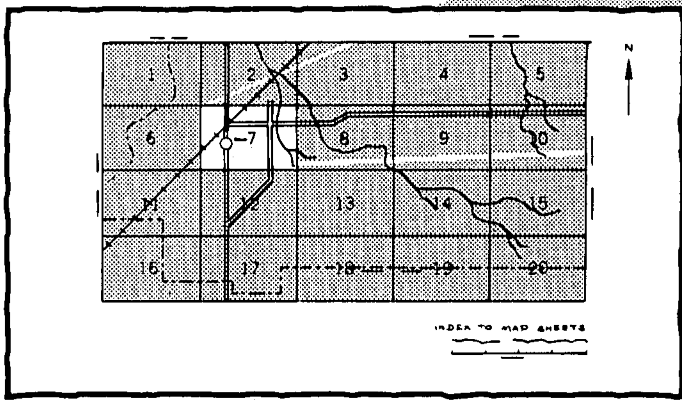
Soil
Conservation
Service

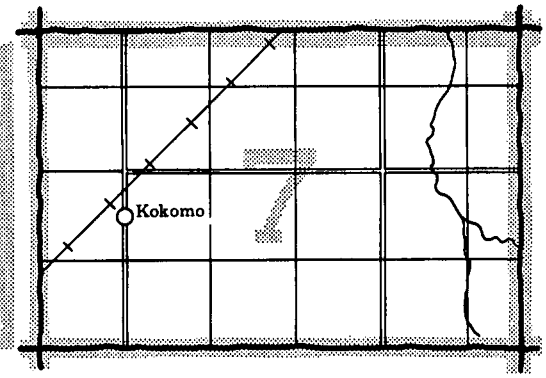
In cooperation with
Iowa Agriculture and
Home Economics
Experiment Station;
Cooperative Extension
Service, Iowa State
University; and Department
of Soil Conservation,
State of Iowa

Soil Survey of Delaware County, Iowa

HOW TO USE

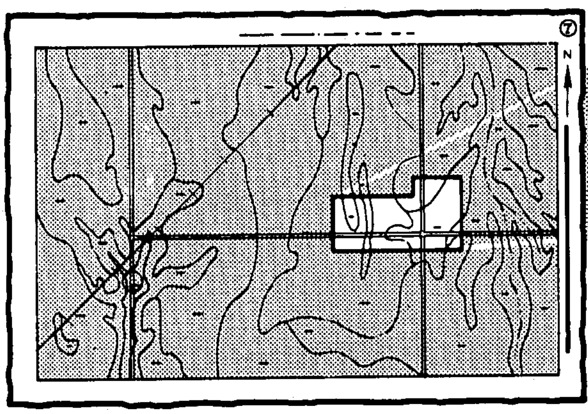
1. Locate your area of interest on the "Index to Map Sheets"

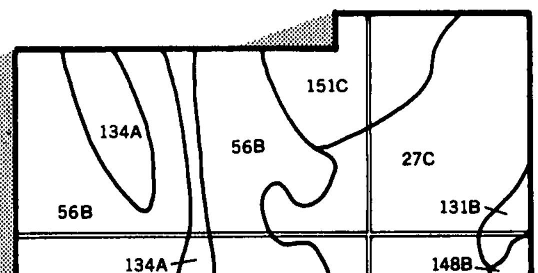




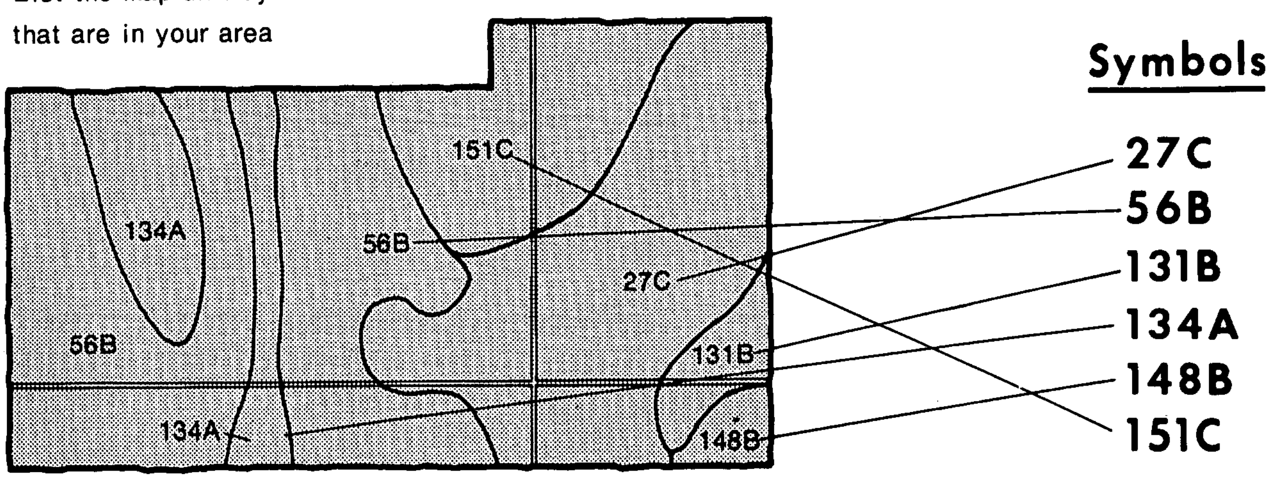
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



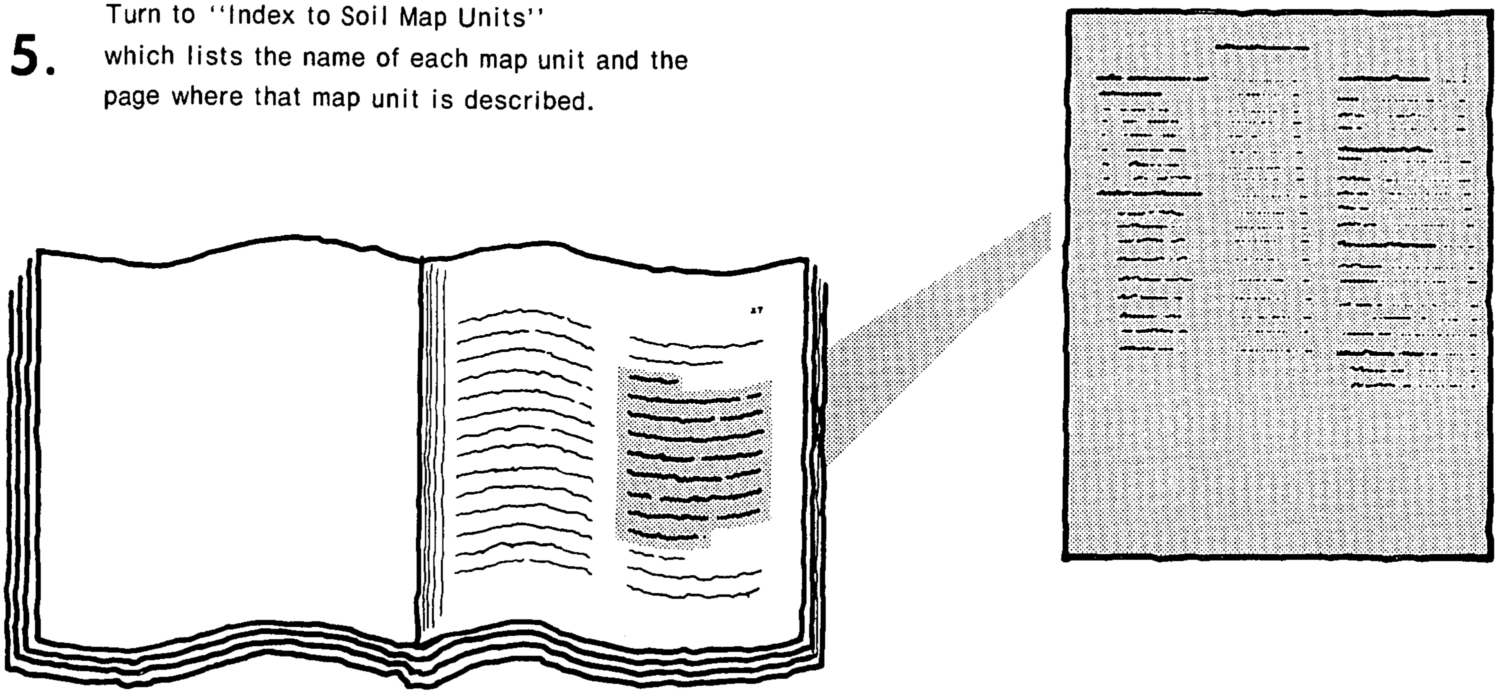


4. List the map unit symbols that are in your area

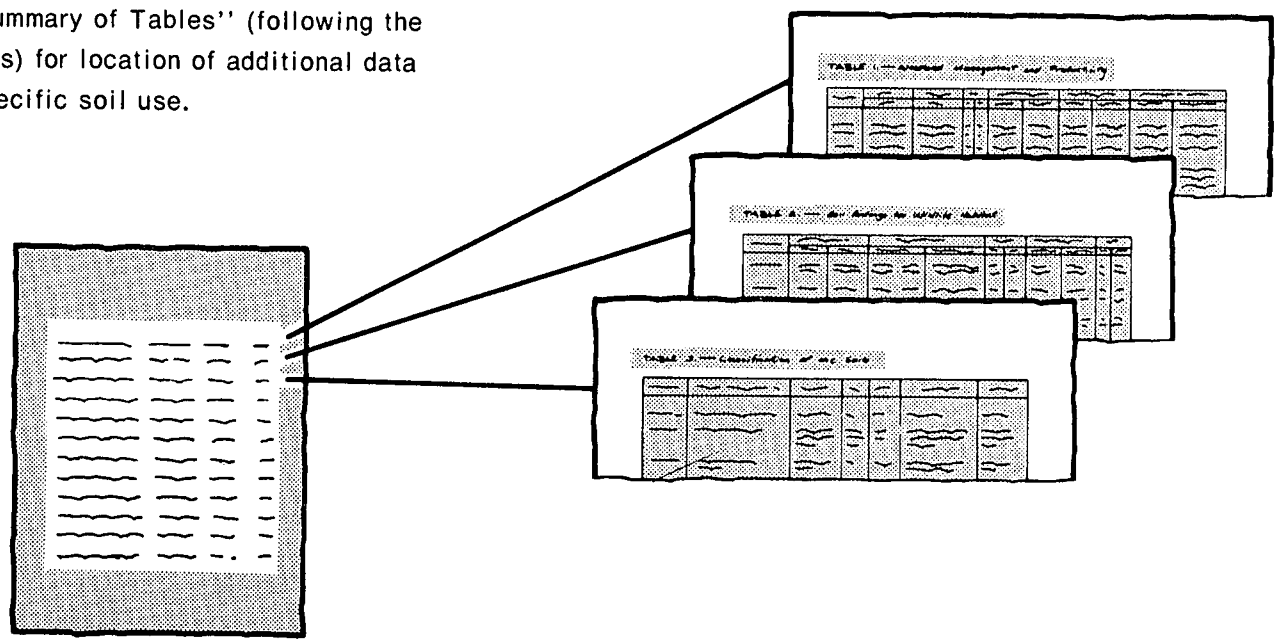


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed during the period 1978 to 1983. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service; the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Department of Soil Conservation, State of Iowa. It is part of the technical assistance furnished to the Delaware County Soil Conservation District. Funds appropriated by Delaware County were used to defray part of the cost of the survey.

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

Cover: Stripcropping on moderately sloping and strongly sloping Fayette soils.

Contents

Soil Series

Issued March 1986

Index to Map Units

Summary of Tables

Preface

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

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

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

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

Soil Survey of
Delaware County, Iowa

By Robin J. Wisner, Soil Conservation Service

Fieldwork by Dale J. Ceolla, Joseph A. Falkenberg, Kevin R. Funni, Bruce D. Seelig, Scott J. Switzer, and Robin J. Wisner, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
In cooperation with
the Iowa Agriculture and Home Economics Experiment Station;
the Cooperative Extension Service, Iowa State University;
and the Department of Soil Conservation, State of Iowa

DELAWARE COUNTY is in the northeastern part of Iowa (fig. 1). It has a total area of 366,720 acres, or 573 square miles. Manchester, the county seat, has a population of 5,611. It is about 47 miles east of Waterloo and 43 miles west of Dubuque.

Most of the acreage is cropland. Most of the cropland is used for corn. Soybeans are grown on a significant acreage in the western part of the county. Hogs and dairy cattle are the principal livestock.

This survey updates the soil survey of Delaware County published in 1925 (*7*). It provides additional information and larger maps, which show the soils in greater detail.

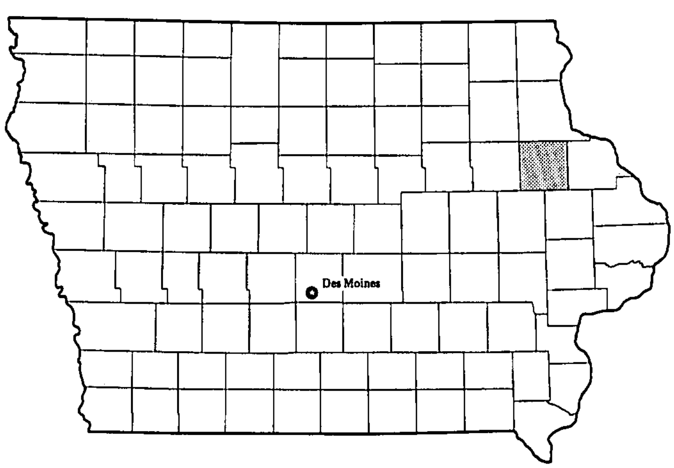


Figure 1.—Location of Delaware County in Iowa.

General Nature of the County

The following paragraphs briefly describe the climate, relief and drainage, history and development, farming, transportation facilities, and natural resources in the county.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

The climate in Delaware County is characterized by cold temperatures in winter and by quite hot temperatures and occasional cool spells in summer. Precipitation frequently occurs as snowstorms during the winter and chiefly as showers, often heavy ones, during the warm months, when warm, moist air moves in from the south. The total annual rainfall is normally adequate for corn, soybeans, and small grain.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Delaware, Iowa, in the period 1951 to 1975. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 20 degrees F, and the average daily minimum temperature is 10 degrees. The lowest temperature on record, which occurred at Delaware on March 1, 1962, is -32 degrees. In summer the average temperature is 70 degrees, and the average daily maximum temperature is 81 degrees. The highest recorded temperature, which occurred at Delaware on July 2, 1963, is 100 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 35.45 inches. Of this, 25 inches, or 70 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 20 inches. The heaviest 1-day rainfall during the period of record was 6.34 inches at Delaware on July 8, 1951. Thunderstorms occur on about 43 days each year, and most occur in summer. Tornadoes and severe thunderstorms strike occasionally. They are local in extent and of short duration and result in sparse damage in narrow belts. Hail falls in scattered small areas at times during the warmer parts of the year.

The average seasonal snowfall is 33 inches. The greatest snow depth at any one time during the period of record was 19 inches. On the average, 6 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour, in spring.

Relief and Drainage

The principal stream in Delaware County is the Maquoketa River. This river flows diagonally through the county from the northwest corner to the southeast corner. It drains about 70 percent of the county. In the northwest corner and directly south of Manchester, the river has cut through limestone, forming a narrow valley with steep limestone bluffs. Between these areas, the river is wider and meanders across its flood plain. Its elevation drops from about 1,000 feet in the northwest to about 800 feet in the southeast. Buffalo Creek flows southeasterly across the southwest corner of the county. It drains about 10 percent of the county. The Little Turkey River and Elk Creek flow northerly in the northeast corner of the county. They drain about 20 percent of the county.

Most of the tributaries to the Maquoketa River are characterized by sharp changes in direction. These changes result from the fractured limestone controlling the directional flow of the tributaries. Plum Creek is an example of this type of drainage pattern. It flows in a southeasterly direction through most of North Fork Township. As it enters South Fork Township, it makes several sharp turns. It flows northwesterly and then southwesterly before entering the Maquoketa River.

The relief in most areas of the county conforms to the gently sloping underlying glacial till. In some areas a gently sloping to strongly sloping topography is controlled by limestone. The strongly sloping to very steep topography in the northeast corner of the county also is controlled by limestone. The highest and lowest elevations are in this part of the county. The highest elevation, in an area south of Edgewood, is about 1,210 feet above sea level. The lowest, in an area along Elk Creek, is about 750 feet.

History and Development

The area now known as Delaware County was acquired by the United States as part of the Louisiana Purchase in 1803. It was ceded to the United States by treaty from the Sac and Fox Indians in 1832. The first settler was William Bennett. In 1836, he built a cabin in section 35 of Honey Creek Township. The first farm of any considerable size was established in 1838, when Joel Bailey broke 20 acres of ground near Bailey's Ford. Delaware County was formally organized in 1839 by the Iowa Territorial Legislature. It was named by a territorial legislator, Thomas McCraney, in honor of his original home, Delaware County, New York.

In October of 1840, the Territorial Legislature appointed two commissioners to select a site for the county seat. One commissioner was convinced that the best location was Ead's Grove, in section 35 of Honey Creek Township, and the other thought that the most eligible spot was a lake site that was named Delhi in 1842. The two could not agree on the location, so they decided to flip a coin. The commissioner favoring Ead's Grove won the toss. The people of the county were angry with the way the decision was made, so they petitioned the legislature, asking for a vote on the location of the county seat. In 1841, after the legislature approved the petition, the people selected the lake site that later became Delhi. This election was the first to be held in the county. During the following years, the people voted in a long series of elections on the question of relocating the county seat. After an election in November of 1880 did not settle the matter, the issue was carried to the circuit court, which permanently established Manchester as the county seat.

In 1837, only six settlers lived in the area that later became Delaware County. In 1840, the population of the county was 168. By 1875, it had rapidly increased to about 17,000. It increased to a high of about 21,000 in the early 1900's. The increase during this period was in the rural areas. In 1980, the population was 18,933.

Farming

Farming is the chief economic enterprise in Delaware County. Most of the local income is derived from the sale of cash grain and livestock. Corn is the principal grain, and hogs and dairy cattle are the principal livestock. The county is known as the hog-producing capital of Iowa.

In the 1940's, many landowners in Delaware County recognized problems of water erosion, soil blowing, and the invasion of noxious weeds caused by continuous cropping and inadequate soil drainage. As a result, the Delaware County Soil and Water Conservation District was organized on September 29, 1944. It was the 44th district to be organized in Iowa.

In 1982, about 342,500 acres was in farm ownership. The county had about 1,390 farms, which averaged about 247 acres in size. Although the trend in recent years has been towards a decrease in the number of farms, the size of individual farms generally has increased.

Transportation Facilities

Four major highways serve Delaware County. U.S. Highway 20, which traverses the county east and west, and State Highway 13, which traverses the county north and south, intersect near Manchester. State Highway 38 begins near Edgewood and traverses the county from north to south. State Highway 3 enters Delaware County a few miles west of Edgewood and extends easterly along the northern border of the county. Hard-surface county roads connect these highways to nearly all of the smaller communities in the county. Nearly all farms are along farm-to-market roads of crushed limestone or gravel. In most areas these roads follow section lines. Major county roads are well distributed throughout the county.

Two railroad lines serve the county. One traverses the central part of the county east and west. The other begins at Manchester and extends south through Ryan. Dubuque, which is within 50 miles of most areas in Delaware County, has grain terminals for shipment of grain on the Mississippi River.

Bus transportation is available in Manchester. This town has an airport and is within 50 miles of commercial airlines at Waterloo and Cedar Rapids. Motor freight lines serve every trading center in the county.

Natural Resources

Delaware County is abundantly supplied with a variety of natural resources other than agricultural land. Among these are limestone, sand, gravel, trees, and water.

Many sand and gravel pits are along the Maquoketa River and its tributaries. The sand and gravel are used mainly as road-surfacing material and concrete aggregate. Limestone is near the surface in many areas throughout the county. It is crushed and used commercially as roadbuilding material, as concrete aggregate, and as a source of lime for agronomic uses. Some limestone can be used for decorative purposes.

At one time about 30 percent of Delaware County was forest. The forested areas were mainly along the Maquoketa River and in the northeast corner of the county. Most have been cleared and are now used for agricultural purposes. Walnut and oak logs from trees grown in the northeast corner are still being shipped out of the county, and cutting continues throughout the year. The natural beauty of the trees and limestone bluffs along the Maquoketa River and in the northeast corner of the county attracts tourists throughout the year. Several parks that include camping and recreational facilities have been developed in these scenic areas.

Delaware County has a number of permanent streams. The waterflow of these streams is determined mainly by the number and size of the springs along them. Many of the streams are stocked with trout during the spring and fall of each year. Among these are Elk Creek, the Little Turkey River, Spring Creek, Honey Creek, and the Maquoketa River. The springs along Spring Creek have a large enough waterflow to support a trout hatchery. The trout hatched and raised there are used for stocking many of the spring-fed streams in northeast Iowa.

A number of underground aquifers supply water to the rural areas and towns in the county. The water for rural communities generally is drawn from Niagaran Limestone, which overlies arenaceous Maquoketa Limestone and Shale at a depth of as much as 600 feet. Most of the water for towns, which generally require higher yielding aquifers, is drawn from Saint Croix Sandstone, which is 1,500 to 2,000 feet below the surface.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

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

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

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

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

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

Map Unit Composition

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

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

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

General Soil Map Units

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

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

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

Soil Descriptions

1. Kenyon-Clyde-Floyd Association

Nearly level to moderately sloping, moderately well drained to poorly drained soils formed in loamy sediments and in the underlying glacial till; on uplands

This association consists of soils on moderately wide ridgetops, on long, convex side slopes, and in broad drainageways. The drainageways form an integrated dendritic pattern. Many are low gradient. Rounded granite boulders and stones formerly were common on the surface. They were removed before the soils were cultivated. A stone line is common at the boundary between the mantle of loamy sediments and the underlying glacial till. Slopes range from 0 to 9 percent.

This association makes up about 51 percent of the county. It is about 31 percent Kenyon soils, 21 percent Clyde soils, 14 percent Floyd soils, and 34 percent minor soils (fig. 2).

Kenyon soils are moderately well drained and are gently sloping and moderately sloping. They are on convex ridgetops and side slopes. Clyde soils are poorly drained and are nearly level to gently sloping. They are in drainageways. Floyd soils are somewhat poorly drained and are nearly level to gently sloping. They are in drainageways.

Typically, the surface layer of the Kenyon soils is black loam about 7 inches thick. The subsurface layer is black and very dark grayish brown loam about 10 inches thick. The subsoil is loam about 37 inches thick. The upper part is brown and friable, and the lower part is mottled dark yellowish brown and yellowish brown and is firm. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown loam.

Typically, the surface layer of the Clyde soils is black clay loam about 9 inches thick. The subsurface layer is black, mottled clay loam about 14 inches thick. The subsoil is about 18 inches thick. The upper part is gray, mottled, friable loam; the next part is mottled gray and yellowish brown, friable loam that has a 1-inch sandy stratum; and the lower part is gray, mottled, firm loam. The substratum to a depth of about 60 inches is mottled gray and yellowish brown loam.

Typically, the surface layer of the Floyd soils is black loam about 9 inches thick. The next layer is black and very dark brown loam about 13 inches thick. The subsoil is about 35 inches thick. The upper part is dark grayish brown, mottled, friable loam and sandy loam; the next part is olive brown and light olive brown, mottled, firm loam; and the lower part is grayish brown, mottled, firm loam. The substratum to a depth of about 60 inches is grayish brown, mottled loam.

The minor soils in this association are the Cresken, Dickinson, Donnan, Olin, and Sparta soils. Cresken soils are moderately well drained and are on convex ridgetops and the upper parts of side slopes. Their surface soil and subsoil are clay loam. Dickinson soils are somewhat excessively drained and are on convex side slopes. Donnan soils are somewhat poorly drained and are on convex ridgetops above the Cresken and Kenyon soils. They have a gray, clayey paleosol at a depth of 20 to 40 inches. Olin soils are well drained and are on convex slopes. They are typically fine sandy loam in the upper part. Sparta soils are excessively drained and are mainly on convex side slopes but in a few areas are on dunelike ridges oriented from the northwest to the southeast. They have textures of loamy fine sand or sand in the surface soil and subsoil.

Most of this association is used for cultivated crops. A few areas are used for permanent pasture or deciduous timber. Most of the pastures are in areas of the poorly drained soils that are not artificially drained. The main farm enterprises are growing corn and soybeans for cash and feeding hogs.

The major soils are well suited or moderately well suited to all of the cultivated crops commonly grown in the county. The main concerns of management are controlling erosion, improving drainage, and maintaining tilth and fertility. A system of conservation tillage that leaves crop residue on the surface, terraces, contour farming, and grassed waterways help to prevent excessive soil loss. Subsurface tile drains help to remove excess water. Most of the soils in this association formed in two different materials. The underlying material is more dense and less permeable than the overlying material. As a result, subsurface water moves laterally down the slope and often surfaces as hillside seepage. A combination of terraces and drainage tile generally is the most effective means of controlling erosion and preventing excessive wetness.

2. Downs-Fayette Association

Gently sloping to moderately steep, well drained soils formed in loess; on uplands

This association consists of soils on narrow ridgetops and long to short, convex side slopes. It is characterized by a well developed network of drainageways. Slopes range from 2 to 18 percent.

This association makes up about 9 percent of the county. It is about 37 percent Downs soils, 25 percent Fayette soils, and 38 percent minor soils (fig. 3).

Downs soils are gently sloping and moderately sloping on ridgetops and are moderately sloping and strongly sloping on convex side slopes. Fayette soils are gently sloping to strongly sloping on ridgetops and are strongly sloping and moderately steep on convex side slopes.

Typically, the surface layer of the Downs soils is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 30 inches thick. It is friable. The upper part is brown silt loam, and the lower part is dark yellowish brown and yellowish brown silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

Typically, the surface layer of the Fayette soils is dark grayish brown silt loam about 8 inches thick. It has dark yellowish brown streaks and pockets. The subsoil is about 33 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

The minor soils in this association are the Colo, Ely, Tama, and Seaton soils. Colo and Ely soils formed in silty alluvium. Colo soils are poorly drained and are in narrow upland drainageways and on bottom land. Ely soils are somewhat poorly drained and are in narrow upland drainageways. Tama soils are well drained and are on upland ridgetops and nose slopes. Their surface layer is thicker than that of the Downs and Fayette soils. Also, it has a higher content of organic matter. Seaton soils are well drained and are on ridgetops and side slopes on pahas. They are silt loam throughout.

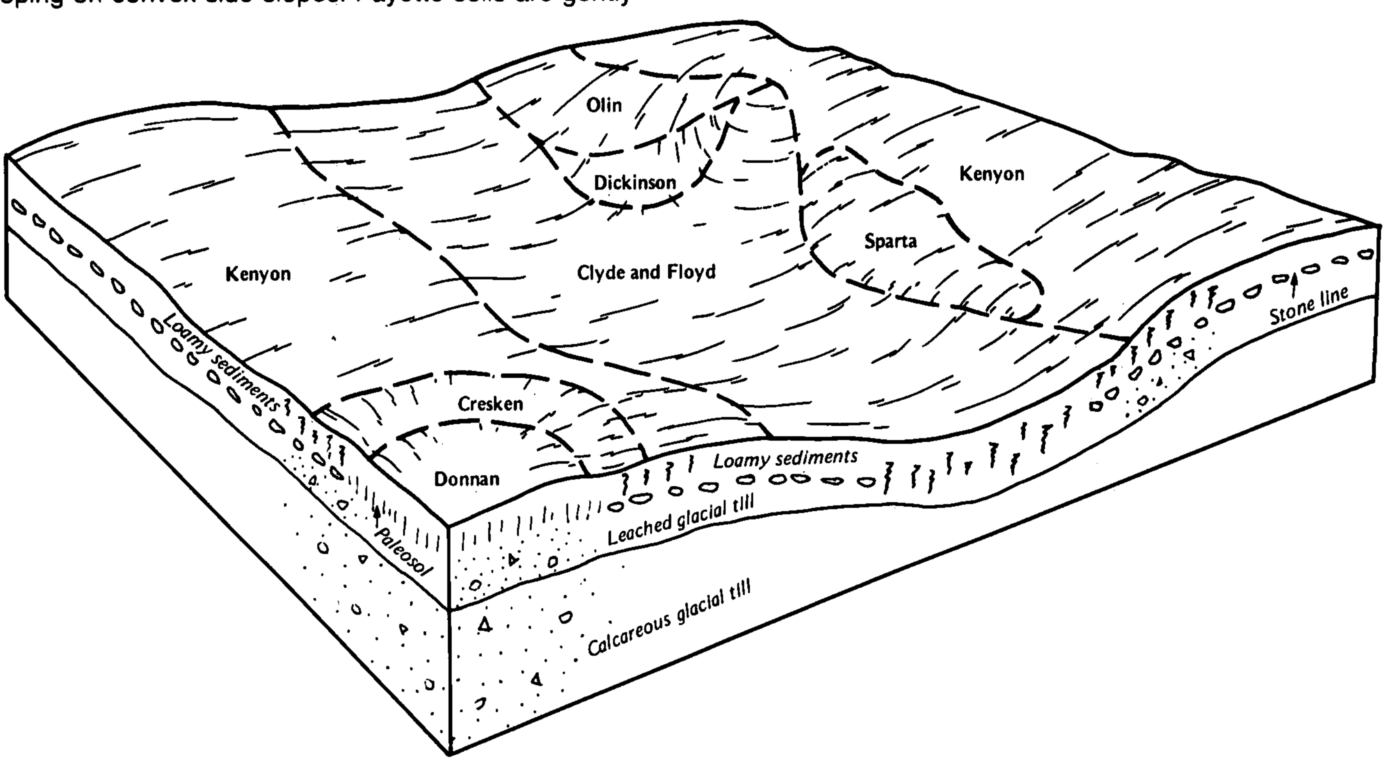


Figure 2.—Pattern of soils and parent material in the Kenyon-Clyde-Floyd association.

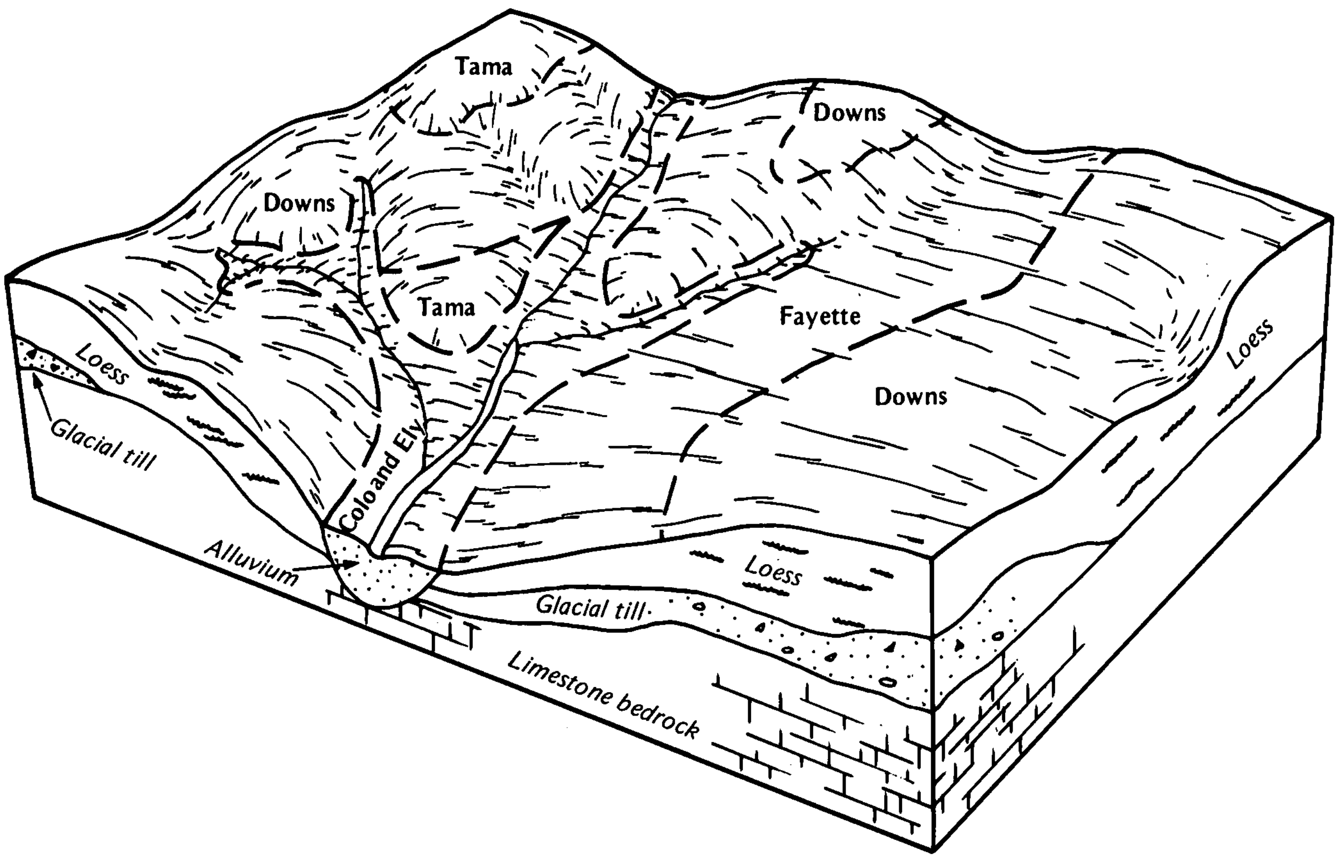


Figure 3.—Pattern of soils and parent material in the Downs-Fayette association.

Most of this association is used for cultivated crops. The only areas used for hay and permanent pasture are the more sloping ones. A few small areas are native forests. The main farm enterprises are growing corn for cash and feeding dairy cattle and hogs.

The major soils generally are well suited or moderately well suited to all of the cultivated crops commonly grown in the county. The steeper soils are suited to cultivated crops occasionally in rotation with hay or pasture. The main concerns of management are controlling erosion and maintaining tilth and fertility. A system of conservation tillage that leaves crop residue on the surface, terraces, contour stripcropping, and grassed waterways help to prevent excessive soil loss.

3. Nordness-Backbone-Bassett Association

Gently sloping to steep, well drained and moderately well drained soils formed in loess or loamy sediments and in the underlying glacial till or limestone residuum; on uplands

This association consists of shallow to deep soils on narrow ridgetops and short, convex side slopes. It is characterized by a poorly developed network of drainageways, which commonly change direction at right angles following crevices in the limestone bedrock. Slopes range from 2 to 25 percent.

This association makes up about 12 percent of the county. It is about 25 percent Nordness soils, 15 percent Backbone soils, 14 percent Bassett soils, and 46 percent minor soils.

Nordness soils are shallow and well drained. They are gently sloping on ridgetops and moderately sloping to steep on side slopes. Backbone and Bassett soils also are on ridgetops and side slopes. They are gently sloping and moderately sloping. Backbone soils are moderately deep and well drained, and Bassett soils are deep and moderately well drained.

Typically, the surface layer of the Nordness soils is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 10 inches thick. It is brown. The upper part is friable silt loam, and the lower part is firm silty clay. Fractured limestone bedrock is at a depth of about 18 inches.

Typically, the surface layer of the Backbone soils is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is brown fine sandy loam about 4 inches thick. The subsoil is about 20 inches thick. The upper part is dark yellowish brown, very friable sandy loam, and the lower part is dark brown, very firm clay loam. Fractured limestone bedrock is at a depth of about 32 inches.

Typically, the surface layer of the Bassett soils is very dark grayish brown loam about 7 inches thick. The subsurface layer is dark grayish brown loam about 6 inches thick. The subsoil is loam about 37 inches thick. The upper part is brown and friable, and the lower part is yellowish brown, mottled, and firm. The substratum to a depth of about 60 inches is mottled strong brown and grayish brown loam.

The minor soils in this association are the Bertram, Chelsea, Goss, Rockton, Sogn, and Whalan soils. Bertram soils are somewhat excessively drained and are on ridgetops and the upper parts of side slopes. Chelsea soils are excessively drained and are on dune-shaped ridges oriented from the northwest to the southeast. Goss and Sogn soils are somewhat excessively drained and are on the upper parts of side slopes. Rockton and Whalan soils are well drained and are on broad ridgetops. They typically have a surface layer of loam. They are 20 to 40 inches deep over limestone bedrock.

Most of the soils in this association are poorly suited to cultivated crops. They are better suited to pasture and hay. The main farm enterprises are growing corn for cash, managing pasture and hayland, and feeding dairy cattle and hogs. The main concerns of management are controlling erosion and maintaining tilth and fertility. The limited depth to bedrock also is a major concern in most areas. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Most areas cannot be terraced because of the shallowness to bedrock and the many outcrops of limestone bedrock.

4. Fayette-Chelsea Association

Gently sloping to steep, well drained and excessively drained soils formed in loess and eolian sand; on uplands and alluvial terraces

This association consists of soils on narrow ridgetops and short, convex or plane side slopes. It is characterized by a well developed network of drainageways. Slopes range from 2 to 25 percent.

This association makes up about 4 percent of the county. It is about 40 percent Fayette soils, 30 percent Chelsea soils, and 30 percent minor soils.

Fayette soils are well drained and are gently sloping to steep. They are on ridgetops and side slopes. Chelsea soils are excessively drained and are gently sloping to moderately steep. They are mainly on ridgetops and side slopes. In some areas, however, they are on dunelike ridges oriented from the northwest to the southeast.

Typically, the surface layer of the Fayette soils is dark grayish brown silt loam about 8 inches thick. It has dark yellowish brown streaks and pockets. The subsoil is about 33 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

Typically, the surface layer of the Chelsea soils is very dark gray loamy fine sand about 4 inches thick. The subsurface layer is about 33 inches thick. The upper part is brown, very friable loamy fine sand, and the lower part is yellowish brown, loose loamy fine sand. Below this to a depth of about 60 inches is yellowish brown, loose fine sand that has bands of brown loamy fine sand 1/4 to 2 inches thick.

The minor soils in this association are the Arenzville, Chaseburg, Colo, Ely, and Ossian soils. The moderately well drained Arenzville and well drained Chaseburg soils formed in light colored silty alluvium in narrow upland drainageways. The poorly drained Colo and Ossian soils are on bottom land. The somewhat poorly drained Ely soils are on concave foot slopes and in upland drainageways.

Most of this association is used for cultivated crops. The only areas used for permanent pastures are those where the soils are droughty and more sloping. A few areas are native forests. The main farm enterprises are growing corn for cash, managing hayland and pasture, and feeding dairy cattle and hogs.

The major soils are moderately well suited or poorly suited to all of the cultivated crops commonly grown in the county. The main concerns of management are controlling erosion and maintaining tilth and fertility. The droughty nature of the Chelsea soils also is a management concern. A system of conservation tillage that leaves crop residue on the surface, terraces, contour stripcropping, and grassed waterways help to prevent excessive soil loss. The steeper slopes and sandy areas are not suitable for terracing.

5. Spillville-Saude-Marshan Association

Nearly level to gently sloping, well drained to poorly drained soils formed in loamy alluvium or in loamy material underlain by sand and gravel; on bottom land and alluvial terraces

This association consists of soils on wide alluvial terraces and moderately wide flood plains. Abandoned channels are common in some areas on the flood plains. Slopes range from 0 to 5 percent.

This association makes up about 7 percent of the county. It is about 25 percent Spillville soils, 24 percent Saude soils, 18 percent Marshan soils, and 33 percent minor soils (fig. 4).

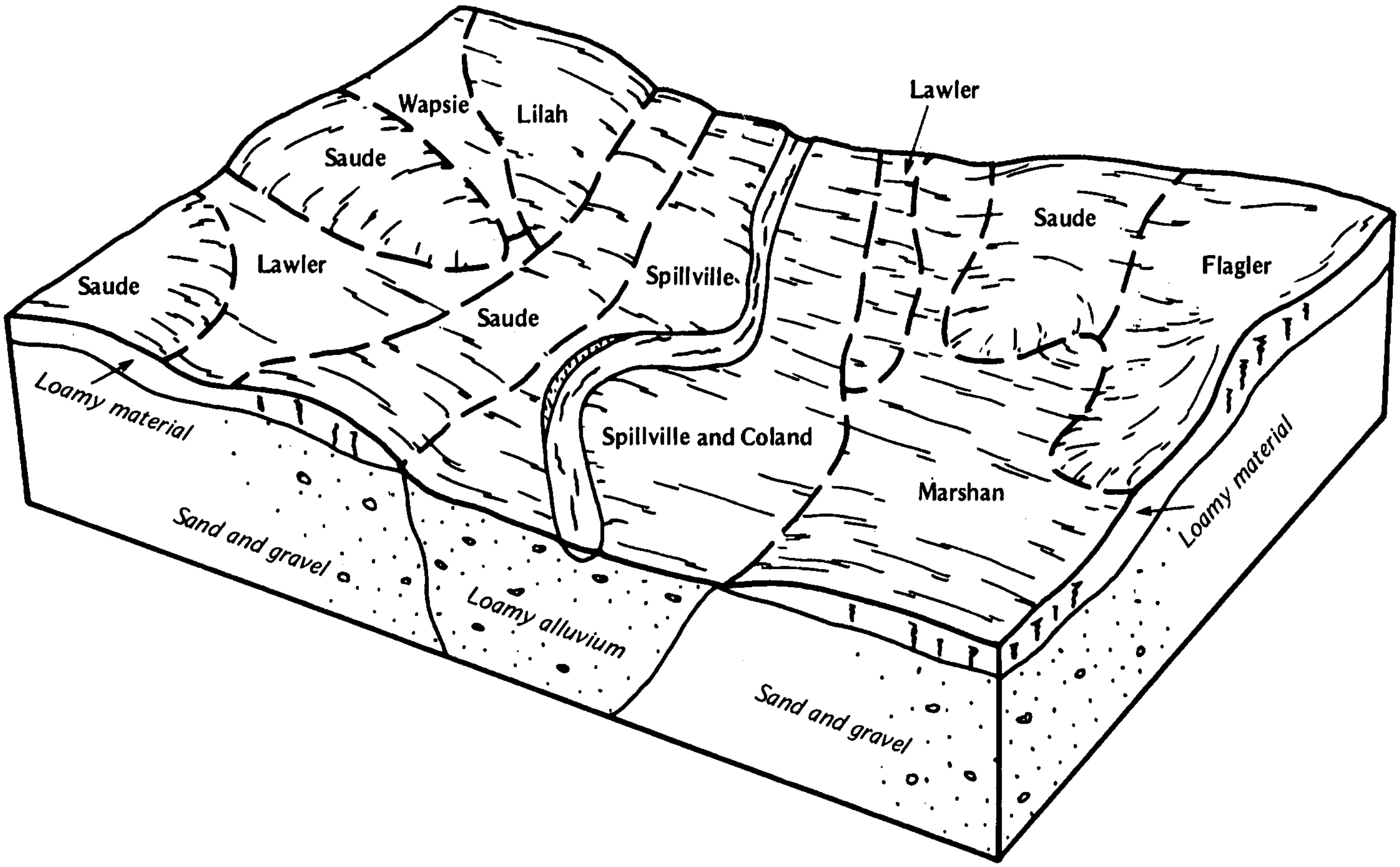


Figure 4.—Pattern of soils and parent material in the Spillville-Saude-Marshan association.

Spillville soils are moderately well drained and somewhat poorly drained and are nearly level. They are on bottom land. Saude and Marshan soils are on alluvial terraces. Saude soils are well drained and are nearly level to gently sloping. Marshan soils are poorly drained and are nearly level or slightly depressional.

Typically, the surface layer of the Spillville soils is black loam about 7 inches thick. The subsurface layer is black and very dark gray loam about 34 inches thick. The upper part of the substratum is brown, mottled loam. The lower part to a depth of about 60 inches is mottled yellowish brown and light brownish gray sandy loam.

Typically, the surface layer of the Saude soils is black loam about 7 inches thick. The subsurface layer is very dark brown loam about 6 inches thick. The subsoil is about 16 inches thick. It is friable. The upper part is dark brown and dark yellowish brown loam, and the lower part is dark yellowish brown sandy loam. The substratum to a depth of about 60 inches is yellowish brown gravelly coarse sand.

Typically, the surface layer of the Marshan soils is black clay loam about 7 inches thick. The subsurface layer also is black clay loam. It is about 15 inches thick. The subsoil is about 16 inches thick. The upper part is very dark gray, friable clay loam; the next part is dark gray, mottled, friable loam; and the lower part is light brownish gray, mottled, very friable sandy loam. The substratum to a depth of about 60 inches is light brownish gray, mottled gravelly sand.

The minor soils in this association are the Coland, Flagler, Lawler, Lilah, and Wapsie soils. The poorly drained Coland soils are on bottom land. The somewhat excessively drained Flagler, somewhat poorly drained Lawler, excessively drained Lilah, and well drained Wapsie soils are on alluvial terraces. Lawler soils have sand and gravel at a depth of 24 to 40 inches. The surface layer of Wapsie soils is thinner than that of the Saude soils. Also, it has a lower content of organic matter.

This association is used for cultivated crops, pasture, and wildlife habitat. Most of the trees, wildlife habitat,

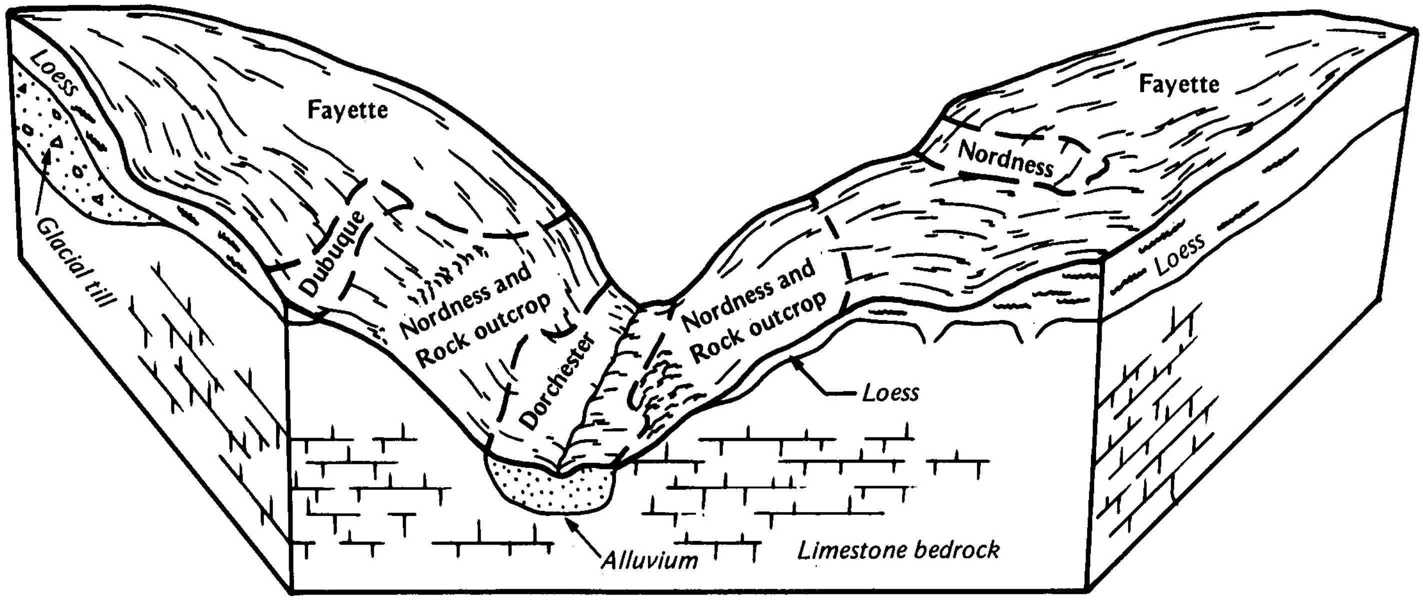


Figure 5.—Pattern of soils and parent material in the Fayette-Nordness-Rock outcrop association.

and pasture are on the bottom land. The main farm enterprises are growing corn and soybeans for cash and feeding hogs.

The major soils generally are well suited or moderately well suited to all of the cultivated crops commonly grown in the county. In some areas on bottom land, however, they are not suitable for cultivation. The main concerns of management are flooding, drainage, and drought, which is a hazard during periods of below normal rainfall. Subsurface tile drains can be installed to help remove excess water.

6. Fayette-Nordness-Rock Outcrop Association

Rock outcrop and moderately sloping to very steep, well drained soils formed in loess or in loess and the underlying limestone residuum; on uplands

This association consists of Rock outcrop and deep and shallow soils on narrow ridgetops and short, convex side slopes. Very steep limestone bluffs rise abruptly 75 to 240 feet above narrow, meandering valleys. A well developed network of drainageways characterizes the association. In some areas the drainage pattern is controlled by limestone near the surface. Slopes range from 5 to 60 percent.

This association makes up about 12 percent of the county. It is about 55 percent Fayette soils, 10 percent Nordness soils and Rock outcrop, and 35 percent minor soils (fig. 5).

The deep Fayette soils are moderately sloping to very steep and are on ridgetops and side slopes. The shallow Nordness soils are moderately sloping to very steep and are on side slopes. Rock outcrop is very steep and is on side slopes.

Typically, the surface layer of the Fayette soils is dark grayish brown silt loam about 8 inches thick. It has dark yellowish brown streaks and pockets. The subsoil is about 33 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

Typically, the surface layer of the Nordness soils is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 10 inches thick. It is brown. The upper part is friable silt loam, and the lower part is firm silty clay. Fractured limestone bedrock is at a depth of about 18 inches.

Typically, the Rock outcrop is limestone bedrock. A thin layer of silt loam or loam covers the bedrock in some areas.

Some of the minor soils in this association are the Dorchester and Dubuque soils. Dorchester soils are moderately well drained and are on narrow bottom land. Dubuque soils are well drained and are on short, convex side slopes. They formed in 20 to 30 inches of loess and in the underlying limestone residuum.

Most of this association is used for pasture or hay. Some areas are managed as woodland. The larger tracts of trees are in areas of the Nordness soils and Rock outcrop. The main farm enterprise is growing hay or pasture plants for feeding dairy cattle.

The less sloping Fayette soils are moderately well suited or poorly suited to all of the cultivated crops commonly grown in the county. The steep and very steep Fayette soils, the Nordness, and the Rock outcrop, however, are unsuitable for cultivation. The main concerns of management are controlling erosion and maintaining tilth and fertility. A combination of terracing, rotating cultivated crops with hay or pasture, and stripcropping helps to prevent excessive soil loss on most of the Fayette soils. A system of conservation tillage that leaves crop residue on the surface also is effective. The steep and very steep Fayette soils, the Nordness soils, and the Rock outcrop are not suitable for terracing because of the slope or the shallowness to limestone bedrock. They are best suited to pasture, woodland, or wildlife habitat.

7. Dinsdale-Sawmill-Tama Association

Very gently sloping to moderately sloping, well drained and poorly drained soils formed in loess, in loess and the underlying glacial till, or in silty alluvium; on uplands

This association consists of soils on narrow or moderately wide, convex ridgetops, on long, convex side slopes, and in broad drainageways. Slopes range from 1 to 9 percent.

This association makes up about 5 percent of the county. It is about 35 percent Dinsdale soils, 20 percent Sawmill soils, 20 percent Tama soils, and 25 percent minor soils (fig. 6).

Dinsdale soils are well drained and are gently sloping on ridgetops and gently sloping and moderately sloping on side slopes. Sawmill soils are poorly drained and are very gently sloping and gently sloping. They are in drainageways. Tama soils are well drained and are gently sloping and moderately sloping. They are on ridgetops and side slopes.

Typically, the surface layer of the Dinsdale soils is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is about 29 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. A stone line separates the loess and the firm underlying glacial till.

Typically, the surface layer of the Sawmill soils is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray silty clay loam about 15 inches thick. The subsoil is mottled, friable silty clay loam about 18 inches thick. The upper part is very dark gray, the next part is dark gray, and the lower part is olive gray. The substratum to a depth of about 60 inches is olive gray, mottled silty clay loam.

Typically, the surface layer of the Tama soils is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown silt loam about 13 inches thick. The subsoil is about 20 inches thick. It is friable. The upper part is brown silty clay loam, the next part is dark yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam mottled with grayish brown.

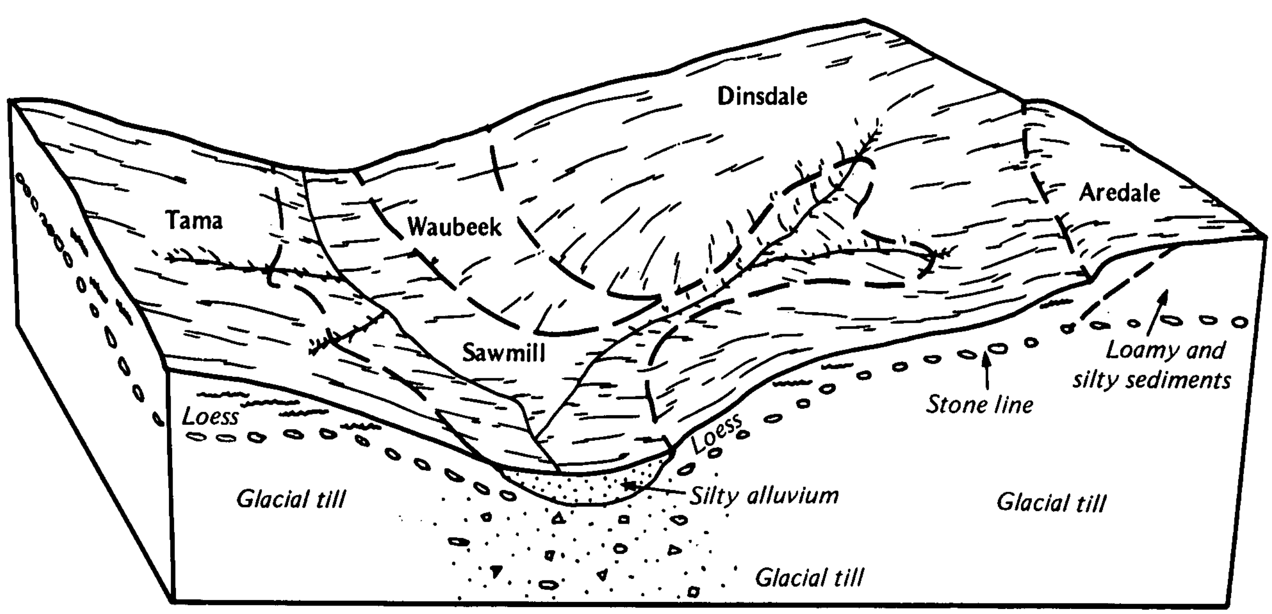


Figure 6.—Pattern of soils and parent material in the Dinsdale-Sawmill-Tama association.

The minor soils in this association are the Aredale, Bolan, and Waubeek soils. Aredale soils are well drained and are on the lower parts of side slopes and nose slopes. They have a surface layer of silt loam. They formed in loamy and silty sediments over glacial till. Bolan soils are well drained and are on the lower parts of side slopes and nose slopes. They typically have a surface layer of loam and a subsoil of loam and fine sandy loam. Waubeek soils are well drained and are on ridgetops and side slopes. Their surface layer is thinner or lighter colored than that of the major soils.

Most of this association is used for cultivated crops. The only areas used for pasture are the undrained ones in the lower lying drainageways. Most of the trees in areas of this association are in groves or windbreaks near farm buildings. The main farm enterprises are growing corn for cash and feeding hogs.

The major soils are well suited or moderately well suited to all of the cultivated crops commonly grown in the county. The main concerns of management are controlling erosion, improving drainage, and maintaining tilth and fertility. A system of conservation tillage that leaves crop residue on the surface, contour farming, terraces, and grassed waterways help to prevent excessive soil loss in areas of the Dinsdale and Tama soils. The wetness of the Sawmill soils can be reduced by a drainage system and by measures that control the runoff from higher adjacent areas.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Kenyon loam, 2 to 5 percent slopes, is one of several phases in the Kenyon series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Clyde-Floyd complex, 1 to 4 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, limestone quarries, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

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

Soil Descriptions

11B—Coly-Ely complex, 2 to 5 percent slopes. These gently sloping soils are in drainageways on uplands. The poorly drained Colo soil is near or within the stream channels or waterways. It is occasionally flooded by local runoff. The somewhat poorly drained Ely soil occurs as narrow bands between the stream channels and the nearby hillsides in the uplands. Areas are long and narrow or irregularly shaped and range from 10 to more than 100 acres in size. They are about 60 percent Colo soil and 30 percent Ely soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the Colo soil has a surface layer of very dark grayish brown silt loam about 8 inches thick. The subsurface layer is about 39 inches thick. It is black silt loam in the upper part and grades to very dark gray, mottled silty clay loam in the lower part. The substratum to a depth of about 60 inches is dark gray, mottled silty clay loam. In places 8 to 18 inches of lighter colored overwash is on the surface.

Typically, the Ely soil has a surface layer of black silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown silty clay loam about 18 inches thick. The subsoil is mottled, friable silty clay loam about 23 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is mottled grayish brown, light olive brown, and strong brown silty clay loam.

Included with these soils in mapping are small areas of soils that have 24 to 36 inches of lighter colored overwash. These included soils are in positions on the landscape similar to those of the Colo soil. They make up about 10 percent of the unit.

Permeability is moderate in the Colo and Ely soils. Runoff is slow on the Colo soil and moderate on the Ely soil. Available water capacity is high in both soils. Both have a seasonal high water table. The content of organic matter is about 3 to 5 percent in the surface layer of the Colo soil and 4 to 6 percent in the surface layer of the Ely soil. Reaction in the surface layer of both soils typically is slightly acid but varies widely as a result of local liming practices. The substratum of the Colo soil generally has a medium supply of available phosphorus and a very low supply of available potassium. The subsoil of the Ely soil generally has a very low supply of available phosphorus and potassium. The surface layer of both soils is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. If artificially drained and protected from runoff from higher lying slopes, these soils are well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Gully erosion is a hazard in areas of concentrated runoff. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Grassed waterways help to prevent gully erosion. A drainage system is needed if row crops are grown. It can lower the water table and improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soils are too wet causes surface compaction and poor tilth, reduces the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

41—Sparta loamy fine sand, 0 to 2 percent slopes. This nearly level, excessively drained soil is on alluvial terraces and on uplands. Areas are irregularly shaped and commonly range from 2 to 30 acres in size.

Typically, the surface layer is very dark brown loamy fine sand about 7 inches thick. The subsurface layer is very dark grayish brown loamy fine sand about 10 inches thick. The subsoil is brown and yellowish brown, very friable loamy fine sand about 27 inches thick. The substratum to a depth of about 60 inches is brownish yellow fine sand. In places it contains gravel.

Permeability is rapid, and runoff is slow. Available water capacity is low. The content of organic matter is about 1 to 2 percent in the surface layer. This layer typically is medium acid unless limed. The subsoil commonly is strongly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled. It warms up early in the spring and can be worked soon after rains.

This soil is used primarily for row crops or for hay and pasture. It is poorly suited to corn, soybeans, and small grain. It is moderately suited to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. If cultivated crops are grown, soil blowing is a hazard. A system of conservation tillage that leaves crop residue on the surface and contour farming conserve moisture and help to prevent excessive soil loss. The hazard of soil blowing is increased by fall plowing. It can be reduced, however, by leaving the surface rough, by alternating plowed and unplowed strips, and by chisel plowing in areas where crop residue is left on the surface. Chisel plowing also conserves moisture. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling soil blowing. Managing pasture is difficult, however, on this droughty soil. Permanent pasture can be improved by renovating and reseeding. Once the permanent pasture has been established, proper stocking rates, pasture rotation, timely deferment of grazing, especially during dry periods, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. It supports trees in groves and around farmsteads, but few areas are extensively wooded. Seedling mortality is severe. As a result, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Competing vegetation can be controlled by careful site preparation or by spraying or cutting.

The land capability classification is IVs.

41B—Sparta loamy fine sand, 2 to 5 percent slopes. This gently sloping, excessively drained soil generally is on convex slopes on uplands that are adjacent to stream valleys. It also is in isolated areas on uplands and alluvial terraces and, in a few areas, is on dunelike ridges oriented from the northwest to the southeast. Areas are irregularly shaped or round and range from 2 to more than 100 acres in size.

Typically, the surface layer is very dark brown loamy fine sand about 7 inches thick. The subsurface layer is very dark grayish brown loamy fine sand about 10 inches thick. The subsoil is very friable loamy fine sand about 27 inches thick. The upper part is brown, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is brownish yellow fine sand. In a few small areas the soil is somewhat excessively drained.

Permeability is rapid, and runoff is slow. Available water capacity is low. The content of organic matter in the surface layer is about 1.0 to 1.5 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is strongly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content. It seldom crusts after hard rains or puddles if tilled when wet.

Most areas are cultivated. Many small areas are cropped along with larger areas of adjacent soils that are well suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay or pasture. Droughtiness is a severe limitation in most years unless rainfall is timely. If cultivated crops are grown, soil blowing is a hazard. The initial soil blowing occurs on round, convex shoulder slopes. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the available water capacity.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted used during wet or dry periods help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. It supports trees in groves and around farmsteads, but few areas are extensively wooded. Seedling mortality is severe. As a result, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Competing vegetation can be controlled by careful site preparation or by spraying or cutting.

The land capability classification is IVs.

41C—Sparta loamy fine sand, 5 to 9 percent slopes. This moderately sloping, excessively drained soil generally is in areas adjacent to drainageways and in isolated areas on uplands. In a few areas it is on dunelike ridges oriented from the northwest to the southwest. Areas generally are irregularly shaped and range from 3 to 10 acres in size, but those on ridges are long and narrow and range from 10 to 20 acres in size.

Typically, the surface layer is very dark brown loamy fine sand about 7 inches thick. The subsurface layer is dark grayish brown loamy fine sand about 9 inches thick. The subsoil is very friable loamy fine sand about 20 inches thick. It is brown in the upper part and yellowish brown in the lower part. The substratum to a depth of about 60 inches is brownish yellow, loose fine sand. In places it is loam glacial till.

Included with this soil in mapping are areas of soils that have a surface layer of gravelly loamy sand or gravelly sandy loam. These soils are in positions on the landscape similar to those of the Sparta soil. They are lower in organic matter content than the Sparta soil and have a lower available water capacity. They make up less than 5 percent of the unit.

Permeability is rapid in the Sparta soil, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is strongly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content. It seldom crusts after hard rains or puddles if tilled when wet.

Most areas are used for pasture. A few small areas are cropped along with larger areas of adjacent soils that are well suited to crops. This soil generally is poorly suited to cultivated crops, but it is suited to small grain and to grasses and legumes for hay or pasture. Droughtiness is a severe limitation in most years unless rainfall is timely. If cultivated crops are grown, soil blowing is a severe hazard.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. It supports trees in groves and around farmsteads, but few areas are extensively wooded. Seedling mortality is severe. As a result, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Competing vegetation can be controlled by careful site preparation or by spraying or cutting.

The land capability classification is IVs.

63B—Chelsea loamy fine sand, 2 to 5 percent slopes. This gently sloping, excessively drained soil generally is on convex slopes on uplands that are adjacent to stream valleys. It also is in isolated areas on alluvial terraces and, in a few areas, on dunelike, low ridges oriented from the northwest to the southeast. Areas are irregularly shaped or round and range from 2 to more than 60 acres in size.

Typically, the surface layer is very dark gray loamy fine sand about 4 inches thick. The subsurface layer is loamy fine sand about 33 inches thick. The upper part is brown and very friable, and the lower part is yellowish brown and loose. Below this to a depth of about 60 inches is yellowish brown, loose fine sand that has bands of brown loamy fine sand 1/4 inch to 2 inches thick. In places the soil has a substratum of loam glacial till or sandy loam.

Permeability is rapid, and runoff is slow. Available water capacity is low. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. Reaction typically varies widely in the surface layer and the upper part of the subsurface layer as a result of local liming practices. The lower part of the subsurface layer ranges from slightly to strongly acid. The subsurface layer generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content. It seldom crusts after hard rains or puddles if tilled when wet.

Most areas are used for pasture. A few small areas are cropped along with larger areas of adjacent soils that are well suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small grain or to grasses or legumes for hay or pasture. Droughtiness is a severe limitation in most years unless rainfall is timely. If cultivated crops are grown, soil blowing is a hazard. The initial soil blowing occurs on round, convex shoulder slopes. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the available water capacity.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. It supports trees in groves and around farmsteads, but few areas are extensively wooded. Seedling mortality is moderate. As a result, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Competing vegetation can be controlled by careful site preparation or by spraying or cutting.

The land capability classification is IVs.

63C—Chelsea loamy fine sand, 5 to 9 percent slopes. This moderately sloping, excessively drained soil generally is on moundlike ridges and convex side slopes on uplands that generally are adjacent to stream valleys. It also is in isolated areas in the glacial uplands and on alluvial terraces. Areas are irregularly shaped or round and range from 3 to 20 acres in size.

Typically, the surface layer is very dark gray loamy fine sand about 4 inches thick. The subsurface layer is loamy fine sand about 33 inches thick. The upper part is brown and very friable, and the lower part is yellowish brown and loose. Below this to a depth of about 60 inches is yellowish brown, loose fine sand that has bands of brown loamy fine sand 1/4 inch to 2 inches thick. In places the surface soil is sandy loam.

Permeability is rapid, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. Reaction typically varies widely in the surface layer and the upper part of the subsurface layer as a result of local liming practices. The lower part of the subsurface layer ranges from slightly to strongly acid. The subsurface layer generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content. It seldom crusts after hard rains or puddles if tilled when wet.

Most areas are used for pasture. A few small areas are cropped along with larger areas of adjacent soils that are well suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small grain or to grasses or legumes for hay or pasture. Droughtiness is a severe limitation in most years unless rainfall is timely. If cultivated crops are grown, soil blowing is a hazard. The initial soil blowing occurs on round, convex shoulder slopes. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil warms up quickly in the spring, thus stimulating early plant growth, particularly on south- and east-facing slopes. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the available water capacity.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. It supports trees in groves and around farmsteads, but few areas are extensively wooded. Seedling mortality is moderate. As a result, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Competing vegetation can be controlled by careful site preparation or by spraying or cutting.

The land capability classification is IVs.

63D—Chelsea loamy fine sand, 9 to 14 percent slopes. This strongly sloping, excessively drained soil is on convex slopes in the uplands. Areas are irregularly shaped and range from 5 to 20 acres in size.

Typically, the surface layer is very dark gray loamy fine sand about 4 inches thick. The subsurface layer is about 31 inches of dark grayish brown, brown, and yellowish brown, loose loamy fine sand and fine sand. The subsoil is yellowish brown, loose fine sand about 20 inches thick. It has many bands of dark brown sandy loam 1/4 inch to 2 inches thick. In places the surface layer is dark brown fine sandy loam.

Permeability and runoff are rapid. Available water capacity is low. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. Reaction typically ranges from medium acid to neutral in the surface layer and from slightly acid to strongly acid in the subsurface layer. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content. It seldom crusts after hard rains or puddles if tilled when wet.

Most areas are used for pasture. This soil generally is unsuitable for cultivated crops, mainly because it is droughty, low in fertility, and highly susceptible to water erosion. Also, soil blowing is a hazard. Windblown sand grains can damage seedlings on this soil and on the adjacent soils.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during dry periods, help to keep the pasture and the soil in fairly good condition.

A few areas support native hardwoods. This soil is moderately well suited to trees. The pastured areas can be converted to woodland. Seedling mortality is moderate. As a result, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Competing vegetation can be controlled by careful site preparation or by spraying or cutting.

The land capability classification is VIs.

63E—Chelsea loamy fine sand, 14 to 18 percent slopes. This moderately steep, excessively drained soil is on convex slopes in the uplands. Areas are irregularly shaped and generally are 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown loamy fine sand about 3 inches thick. The subsurface layer is about 30 inches of dark grayish brown, brown, and yellowish brown loamy fine sand and fine sand. The subsoil is yellowish brown, loose fine sand about 27 inches thick. It has many bands of dark brown sandy loam 1/4 inch to 2 inches thick. In some places the surface layer is brown loamy fine sand. In other places the slope exceeds 18 percent.

Permeability and runoff are rapid. Available water capacity is low. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. Reaction typically ranges from medium acid to neutral in the surface layer and from slightly acid to strongly acid in the subsurface layer. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content. It seldom crusts after hard rains or puddles if tilled when wet.

Most areas are used for pasture. A few support native hardwoods. This soil is not suited to cultivated crops and is poorly suited to hay or pasture, mainly because it is droughty, low in fertility, and moderately steep. Also, it is subject to soil blowing. As a result, a permanent plant cover is needed.

A cover of pasture plants or hay is effective in controlling soil blowing. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during dry periods, help to keep the pasture and the soil in fairly good condition. Renovating pastures is difficult because slopes are too steep for the use of ordinary farm machinery.

This soil is moderately well suited to trees. The pastured areas can be converted to woodland. The equipment limitation is severe, and seedling mortality and the hazard of erosion are moderate. Seedlings should be planted at close intervals because the survival rate is limited. Thinning the stand helps to provide adequate growing space for the surviving trees. Measures that control erosion are needed until the trees are large enough to provide a protective cover. Competing vegetation can be controlled by careful site preparation or by spraying or cutting. Because of the slope, special logging equipment is needed. Also, caution is needed in operating this equipment.

The land capability classification is VIIs.

65D2—Lindley loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex nose slopes and side slopes in the uplands. Areas are irregularly shaped and are 5 to 10 acres in size.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. Plowing has mixed some streaks and pockets of brown loam subsoil material into the surface layer. The subsoil is about 36 inches thick. It is firm. The upper part is brown loam, the next part is strong brown clay loam, and the lower part is strong brown, mottled clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. In some areas the surface layer is mixed brown and yellowish brown loam.

Permeability is moderately slow, and runoff is rapid. Available water capacity is moderate or high. The content of organic matter is less than 0.5 percent in the surface layer. This layer typically is medium acid or strongly acid unless limed. The subsoil is strongly acid or very strongly acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are used for permanent pasture or are cultivated. This soil is poorly suited to corn and soybeans. If cultivated crops are grown, erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Growing the row crops in rotation with oats, hay, and pasture also is helpful. The soil is not suitable for terracing. It is low in fertility and has a highly dense subsoil. Revegetating is difficult if the subsoil is exposed. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas are wooded. This soil is moderately well suited to trees. Laying out logging trails or roads on the contour or nearly on the contour helps to control erosion. Seedling mortality is slight.

The land capability classification is IVe.

65E3—Lindley clay loam, 14 to 18 percent slopes, severely eroded. This moderately steep, moderately well drained soil is on short, convex side slopes and nose slopes in the uplands. Areas are elongated and are 5 to 10 acres in size.

Typically, the surface layer is brown clay loam about 7 inches thick. Streaks and pockets of grayish brown loam make up 15 to 20 percent of this layer. The subsoil is firm clay loam about 28 inches thick. The upper part is brown, the next part is strong brown, and the lower part is strong brown and mottled. The substratum to a depth of about 60 inches is strong brown, mottled, firm loam. In some areas the surface layer is mixed dark grayish brown and brown loam.

Permeability is moderately slow, and runoff is very rapid. Available water capacity is moderate or high. The content of organic matter is less than 0.5 percent in the surface layer. This layer typically is strongly acid unless it has been limed within the last 5 years. The subsoil typically is strongly acid or very strongly acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable. If cultivated, however, the soil tends to become cloddy and to puddle and crust after hard rains. The puddling and crusting increase the runoff rate and retard plant growth.

Although formerly cultivated, most areas are used for permanent pasture. This soil is unsuitable for cultivated crops because further erosion is a severe hazard and in some areas slopes are too steep for the use of ordinary farm machinery. Regularly adding organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in fairly good condition.

A few areas are wooded. This soil is moderately well suited to trees. Seedling mortality, the equipment limitation, and the hazard of erosion are moderate. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed in operating this equipment. Seedlings should be planted at close intervals because the survival rate is limited. Thinning the stand helps to provide adequate growing space for the surviving trees.

The land capability classification is VIIe.

83B—Kenyon loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on long, convex ridgetops and side slopes in the uplands. Areas are irregularly shaped and range from 2 to more than 100 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is black and very dark grayish brown loam about 10 inches thick. The subsoil is loam about 37 inches thick. The upper part is brown and friable, and the lower part is dark yellowish brown and yellowish brown, mottled, and firm. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown loam. In places the surface soil is lighter colored and contains less organic matter.

Included with this soil in mapping are small areas of the somewhat poorly drained Floyd and Readlyn soils. Floyd soils are along upland drainageways, and Readlyn soils are at the head of drainageways. In some areas fieldwork is delayed unless the Floyd and Readlyn soils are drained. These soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Kenyon soil, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. In some areas reaction varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid or slightly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial till. Tiling this soil may leave rock fragments of cobble size on the surface. These cobbles are from the stone line at the boundary between the loamy sediments and the underlying glacial till. They can hinder tillage if left on the surface. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

83C—Kenyon loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on short side slopes in the uplands. Areas are commonly somewhat narrow, irregularly shaped bands that range from 2 to 12 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is loam about 37 inches thick. The upper part is brown and friable, and the lower part is dark yellowish brown and yellowish brown, mottled, and firm. The substratum to a depth of about 60 inches is mottled brown and grayish brown loam. In places the surface soil is lighter colored and has a lower content of organic matter.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. In some areas reaction varies in the surface layer as a result of local liming practices. It typically is medium acid or slightly acid in the subsoil. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn and soybeans. It is well suited to small grain and to grasses or legumes for hay or pasture. If cultivated crops are grown, erosion is a moderate or severe hazard. Terraces, a system of conservation tillage that leaves crop residue on the surface, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial till. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

83C2—Kenyon loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on short side slopes in the uplands. Areas commonly are somewhat narrow, irregularly shaped bands that range from 3 to 20 acres in size.

Typically, the surface layer is very dark grayish brown and brown loam about 7 inches thick. Plowing has mixed some streaks and pockets of dark yellowish brown loam subsoil material into the surface layer. The subsoil is loam about 35 inches thick. The upper part is dark yellowish brown and friable, and the lower part is yellowish brown and firm. The substratum to a depth of about 60 inches is mottled yellowish brown and light brownish gray loam.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. In some areas reaction varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid or slightly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn and soybeans. It is well suited to small grain and to grasses or legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. Terraces and a system of conservation tillage that leaves crop residue on the surface help to prevent excessive soil loss. Grassed waterways help to prevent gully erosion. If terraces are built, cuts should not expose the less productive underlying glacial till. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen generally is needed on this soil than on Kenyon soils that are less eroded. Also, more intensive management is needed to maintain productivity and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

84—Clyde clay loam, 0 to 3 percent slopes. This nearly level and very gently sloping, poorly drained soil is in drainageways and the lower concave areas on uplands. Areas are generally elongated and irregularly shaped and range from 10 to 60 acres in size.

Typically, the surface layer is black clay loam about 9 inches thick. The subsurface layer is black, mottled clay loam about 14 inches thick. The subsoil is about 18 inches thick. The upper part is gray, mottled, friable loam; the next part is mottled gray and yellowish brown, friable loam that has a sandy stratum 1 inch thick; and the lower part is gray, mottled, firm loam. The substratum to a depth of about 60 inches is mottled gray and yellowish brown loam. In places the surface soil is thicker and darker.

Included with this soil in mapping are small areas of the somewhat poorly drained Floyd and Schley soils. These soils are at the head of drainageways in the slightly higher landscape positions. They make up about 10 percent of the unit.

Permeability is moderate in the Clyde soil, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 7 to 9 percent. Reaction typically is neutral or slightly acid throughout the profile. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Inadequately drained areas generally are used for pasture. If artificially drained and protected against runoff from the higher elevations, this soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses or legumes for hay and pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Glacial stones and boulders are common in many unimproved, undrained areas. They should be removed before the soil is tile drained and cultivated. Installing the tile is difficult in some areas because of the very friable, water-bearing sandy sediments. Tiling this soil may leave rock fragments of cobble size on the surface. These cobbles are from the stone line at the boundary between the loamy sediments and the underlying glacial till. They can hinder tillage if left on the surface. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

109B—Backbone fine sandy loam, 2 to 5 percent slopes. This gently sloping, moderately deep, well drained soil is on convex ridges and side slopes in the uplands. Areas are irregularly shaped and range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is pale brown fine sandy loam about 4 inches thick. The subsoil is about 20 inches thick. The upper part is dark yellowish brown, very friable sandy loam, and the lower part is dark brown, very firm clay loam. Fractured limestone bedrock is at a depth of about 32 inches. In places the subsoil has thin layers of loamy sand.

Permeability is moderately rapid in the upper part of the profile and moderately slow in the lower part. Runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 1 to 2 percent. The shrink-swell potential is high in the lower part of the subsoil. The root zone extends only to the limestone bedrock. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is neutral. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Some areas are cultivated. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses or legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. If cultivated crops are grown, soil blowing is a hazard. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface, cover crops, and grassed waterways help to prevent excessive soil loss. The soil warms up quickly in the spring, thus stimulating early plant growth, particularly on south- and east-facing slopes. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is moderately well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IVs.

109C—Backbone fine sandy loam, 5 to 9 percent slopes. This moderately sloping, moderately deep, well drained soil is on convex ridges and side slopes in the uplands. Areas are elongated and are 5 to 10 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is brown fine sandy loam about 4 inches thick. The subsoil is about 20 inches thick. The upper part is dark yellowish brown, friable fine sandy loam; the next part is dark yellowish brown, friable sandy loam; and the lower part is dark brown, firm clay loam. Fractured limestone bedrock is at a depth of about 32 inches. In places the surface layer is mixed with dark yellowish brown subsoil material.

Permeability is moderately rapid in the upper part of the profile and moderately slow in the lower part. Runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 1 to 2 percent. The shrink-swell potential is high in the lower part of the subsoil. The root zone extends only to the limestone bedrock. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is neutral. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are used for pasture. A few are cultivated. This soil is poorly suited to cultivated crops because it is droughty, is subject to erosion, and has a limited root zone. Tillage may be difficult because of the shallowness to limestone bedrock. Cultivated crops should be grown only to reestablish meadows. Measures that control runoff and help to prevent excessive soil and moisture losses are needed. A system of conservation tillage that leaves crop residue on the surface helps to control soil blowing and water erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in preventing excessive soil loss. Overgrazing, however, increases the susceptibility to soil blowing and water erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during dry periods, help to keep the pasture and the soil in fairly good condition.

A few areas support native hardwoods. This soil is moderately well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IVs.

110B—Lamont fine sandy loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex slopes on alluvial terraces and glaciated uplands that generally are adjacent to stream valleys. Areas are irregularly shaped and range from about 5 to 80 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 5 inches thick. The subsurface layer is brown fine sandy loam about 6 inches thick. The subsoil is brown and strong brown, friable and very friable fine sandy loam about 20 inches thick. The substratum to a depth of about 60 inches is brownish yellow and light yellowish brown loamy fine sand. It has nearly horizontal layers of strong brown loamy sand 1/2 inch to 2 inches thick. In some places the soil is nearly level. In other places the substratum is loam glacial till.

Included with this soil in mapping are small areas of the excessively drained Chelsea soils. These soils are in positions on the landscape similar to those of the Lamont soil. They are slightly lower in organic matter content than the Lamont soil, have a lower available water capacity, and are more susceptible to soil blowing. They make up about 5 percent of the unit.

Permeability is moderately rapid in the Lamont soil, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 0.5 percent. Reaction varies in the surface layer as a result of local liming practices. The subsoil is slightly acid to strongly acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Some areas are cultivated. Many small areas are cropped along with large areas of adjacent soils that are well suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to grasses or legumes for hay and pasture. If cultivated crops are grown, soil blowing is a hazard. The initial soil blowing occurs on round, convex shoulder slopes. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface, cover crops, and grassed waterways help to prevent excessive soil loss. The soil is poorly suited to terracing because ridging the moderately coarse textured material is difficult and because the underlying coarse textured material is too close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. Droughtiness is a limitation in most years unless rainfall is timely. The soil warms up quickly in the spring, thus stimulating early plant growth, particularly on south- and east-facing slopes. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the available water capacity.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is moderately well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

110C—Lamont fine sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on ridges and side slopes on uplands and alluvial terraces. Areas are irregularly shaped and are about 5 to 10 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 5 inches thick. The subsurface layer is grayish brown fine sandy loam about 6 inches thick. The subsoil is about 20 inches thick. It is yellowish brown and friable. The upper part is fine sandy loam, and the lower part is sandy loam. The substratum to a depth of about 60 inches is yellowish brown loamy fine sand that has thin bands of brown and dark brown, friable sandy loam. In some areas the substratum is loam glacial till.

Included with this soil in mapping are small areas of the excessively drained Chelsea soils. These soils are more droughty than the Lamont soil and have a lower content of organic matter in the surface layer. They are in positions on the landscape similar to those of the Lamont soil. They make up about 5 to 10 percent of the unit.

Permeability is moderately rapid in the Lamont soil, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 0.5 percent. Reaction varies in the surface layer as a result of local liming practices. The subsoil is slightly acid to strongly acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are used for pasture or trees. A few are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture, but it is droughty. Also, soil blowing and water erosion are hazards if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface helps to control soil blowing and water erosion and conserves moisture.

A cover of pasture plants or hay is effective in controlling water erosion and soil blowing. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is moderately well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

119—Muscatine silt loam, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on uplands at the head of drainageways. Individual areas are irregularly shaped and range from 5 to 30 acres in size.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer is black and very dark brown silt loam about 14 inches thick. The subsoil is friable silty clay loam about 21 inches thick. The upper part is dark grayish brown, the next part is olive brown and dark grayish brown and is mottled, and the lower part is grayish brown and mottled. The substratum to a depth of about 60 inches is mottled grayish brown and yellowish brown silt loam. In places the surface soil is thinner and has a lower content of organic matter.

Permeability is moderate, and runoff is slow or medium. Available water capacity is very high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 6 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil typically is slightly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used for hay or pasture. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. In some areas tile drainage is needed to reduce the wetness and improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is I.

120B—Tama silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex ridgetops and nose slopes in the uplands. Areas are irregularly shaped and generally range from 5 to 40 acres in size.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 13 inches thick. The subsoil is about 20 inches thick. It is friable. The upper part is brown silty clay loam, the next part is dark yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam mottled with grayish brown.

Permeability is moderate, and runoff is medium. Available water capacity is high or very high. The content of organic matter is about 3 to 4 percent in the surface layer. This layer typically is neutral or slightly acid. The subsoil is medium acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and stripcropping help to prevent excessive soil loss. Slopes generally are long enough and uniform enough for terracing. Grassed waterways are needed to prevent the formation of gullies. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

120C—Tama silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex side slopes in the uplands. Areas are elongated and generally are 5 to 10 acres in size.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is about 31 inches thick. It is friable. The upper part is brown silty clay loam, the next part is dark yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam mottled with grayish brown. In places the surface layer is mixed very dark brown and brown.

Permeability is moderate, and runoff is medium. Available water capacity is high or very high. The content of organic matter is about 3 to 4 percent in the surface layer. This layer typically is neutral or slightly acid. The subsoil typically is medium acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and stripcropping help to prevent excessive soil loss. Slopes generally are long enough and uniform enough for terracing. Grassed waterways are needed to prevent the formation of gullies. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

129B—Arenzville-Chaseburg silt loams, 2 to 5 percent slopes. These gently sloping, well drained and moderately well drained soils are in narrow upland drainageways. They are subject to flooding. Areas are about 100 to 200 feet wide and are long or irregularly shaped. They range from 25 to 100 acres in size. They are about 50 percent Arenzville soil and 40 percent Chaseburg soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the Arenzville soil has a surface layer of dark grayish brown silt loam about 9 inches thick. The substratum is dark grayish brown, brown, and grayish brown, stratified silt loam about 26 inches thick. Below this to a depth of about 60 inches is an older buried surface layer of very dark grayish brown silt loam.

Typically, the Chaseburg soil has a surface layer of dark grayish brown silt loam about 8 inches thick. The substratum to a depth of more than 60 inches is multicolored, stratified silt loam. In places the surface layer is thicker and darker.

Included with these soils in mapping are small areas of the dark Worthen soils near the foot slopes of the more sloping uplands. These included soils make up about 10 percent of the unit.

Permeability is moderate in the Arenzville and Chaseburg soils, and runoff is medium. Available water capacity is high or very high. The Chaseburg soil has a seasonal high water table. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. The soils typically are neutral or slightly acid throughout. The Arenzville soil generally has a low supply of available phosphorus and a very low supply of available potassium. The Chaseburg soil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer in both soils is friable and can be tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are used for pasture or are cultivated along with the surrounding upland soils. The areas generally are too small to be cropped separately. If protected from flooding and erosion, the Arenzville and Chaseburg soils are suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. They receive high velocity, concentrated runoff from the adjoining, more sloping upland soils. They can be protected from this excess water by diversion terraces on the adjoining upland slopes. In some areas they are seasonally wet because of seepage from the upland slopes. Installing tile in these areas improves the timeliness of fieldwork. Structures that keep gullies from forming are needed in some areas.

Many small, inaccessible areas along narrow drainageways are used as permanent pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

These soils are well suited to most trees. Because they receive runoff from the more sloping upland soils, however, they tend to remain wet for moderately long periods after rainfall. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIe.

133+—Colo silt loam, overwash, 0 to 2 percent slopes. This nearly level, poorly drained soil is on bottom land along small streams. It is subject to flooding. Areas are irregularly shaped and range from 15 to 30 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is about 39 inches thick. It is black silt loam in the upper part and grades to very dark gray, mottled silty clay loam with increasing depth. The substratum to a depth of about 60 inches is dark gray, mottled silty clay loam. In some areas it is silt loam.

Permeability is moderate, and runoff is very slow or ponded. Available water capacity is high or very high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 3 to 5 percent. Reaction typically is slightly acid throughout the profile but varies widely in the surface layer as a result of local liming practices. The soil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used as permanent pasture. If drained and protected from flooding, this soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is wet as a result of the flooding, the very slow or ponded runoff, and the seasonal high water table. The flooding damages crops in some years. Drainage tile can function adequately if outlets are available. Diversion terraces help to control floodwater.

The wetter areas are used mainly as pasture. Overgrazing or grazing during wet periods causes excessive puddling. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

151—Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, poorly drained soil is on alluvial terraces. Areas are irregularly shaped and range from 10 to more than 80 acres in size.

Typically, the surface layer is black clay loam about 7 inches thick. The subsurface layer also is black clay loam. It is about 11 inches thick. The subsoil is about 12 inches thick. The upper part is dark gray and olive gray, mottled, friable clay loam, and the lower part is brownish gray, very friable sandy loam. The substratum to a depth of about 60 inches is light brownish gray, mottled gravelly sand. In places the soil is deeper to sand and gravel.

Included with this soil in mapping are small areas of the excessively drained Sparta and very poorly drained Palms soils. Sparta soils are in the higher lying areas.

Palms soils are in depressions. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Marshan soil and rapid in the lower part. Runoff is slow. Available water capacity is low. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 6 percent. Reaction typically is neutral to medium acid throughout the profile. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Inadequately drained areas generally are used for pasture. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Measures that help to control the runoff from the higher elevations also are needed. Establishing adequate drainage outlets and installing drainage tile are difficult in some areas because of the loose, water-bearing sand and gravel. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

152—Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, poorly drained soil is on alluvial terraces. Areas are irregularly shaped and range from 5 to more than 160 acres in size.

Typically, the surface layer is black clay loam about 7 inches thick. The subsurface layer is black and very dark gray clay loam about 15 inches thick. The subsoil is about 16 inches thick. The upper part is dark gray, friable clay loam, and the lower part is light brownish gray, mottled, very friable sandy loam. The substratum to a depth of about 60 inches is light brownish gray, mottled gravelly sand. In places the soil is shallower to sand and gravel.

Included with this soil in mapping are small areas of the excessively drained Sparta and very poorly drained Palms soils. Sparta soils are in the slightly higher lying areas. Palms soils are in depressions. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Marshan soil and rapid in the lower part. Runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 6 percent. Reaction typically is neutral to medium acid throughout the profile. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Inadequately drained areas generally are used for pasture. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Measures that help to control the runoff from the higher elevations also are needed. Establishing adequate drainage outlets and installing drainage tile are difficult in some areas because of the loose, water-bearing sand and gravel. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

153—Marshan silty clay loam, depressional, 0 to 1 percent slopes. This level, very poorly drained soil is in depressional areas on alluvial terraces. It is subject to ponding and rare flooding. Areas are circular or irregularly shaped and range from 2 to 80 acres in size.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is very dark gray, mottled silty clay loam about 6 inches thick. The subsoil is about 24 inches thick. The upper part is dark gray, mottled, friable silty clay loam, and the lower part is dark gray, mottled, friable sandy loam in which the content of gravel is about 5 percent. The upper part of the substratum is grayish brown, mottled loamy sand in which the content of gravel is 5 to 10 percent. The lower part to a depth of about 60 inches is mottled pale brown, yellowish brown, and grayish brown gravelly sand. In places the depth to sandy loam is as shallow as 16 inches.

Permeability is moderate in the upper part of the profile and rapid in the lower part. Runoff is very slow or ponded. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 8 percent. Reaction in the surface layer typically is neutral but varies as a result of local liming practices. The subsoil is neutral or slightly acid, and the substratum is neutral. The subsoil generally has a low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Undrained areas have water within a few inches of the surface or are ponded. If drained, this soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIw.

158—Dorchester silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is in narrow valleys on bottom land and on wide river bottom land between limestone bluffs (fig. 7). It is subject to flooding. Areas are irregularly shaped and range from 10 to 60 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The substratum is dark grayish brown and brown, stratified silt loam about 37 inches thick. Below this to a depth of about 60 inches is an older buried soil. It is very dark brown silt loam. In places the soil is stratified with sand and silt throughout.

Permeability is moderate, and runoff is slow. Available water capacity is very high. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. Reaction typically is mildly alkaline in the recent stratified sediments and neutral in the buried surface layer. The soil generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas along the narrow valleys are used for pasture, but the broader areas along rivers and the larger streams are cultivated. If protected from flooding, this soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture.

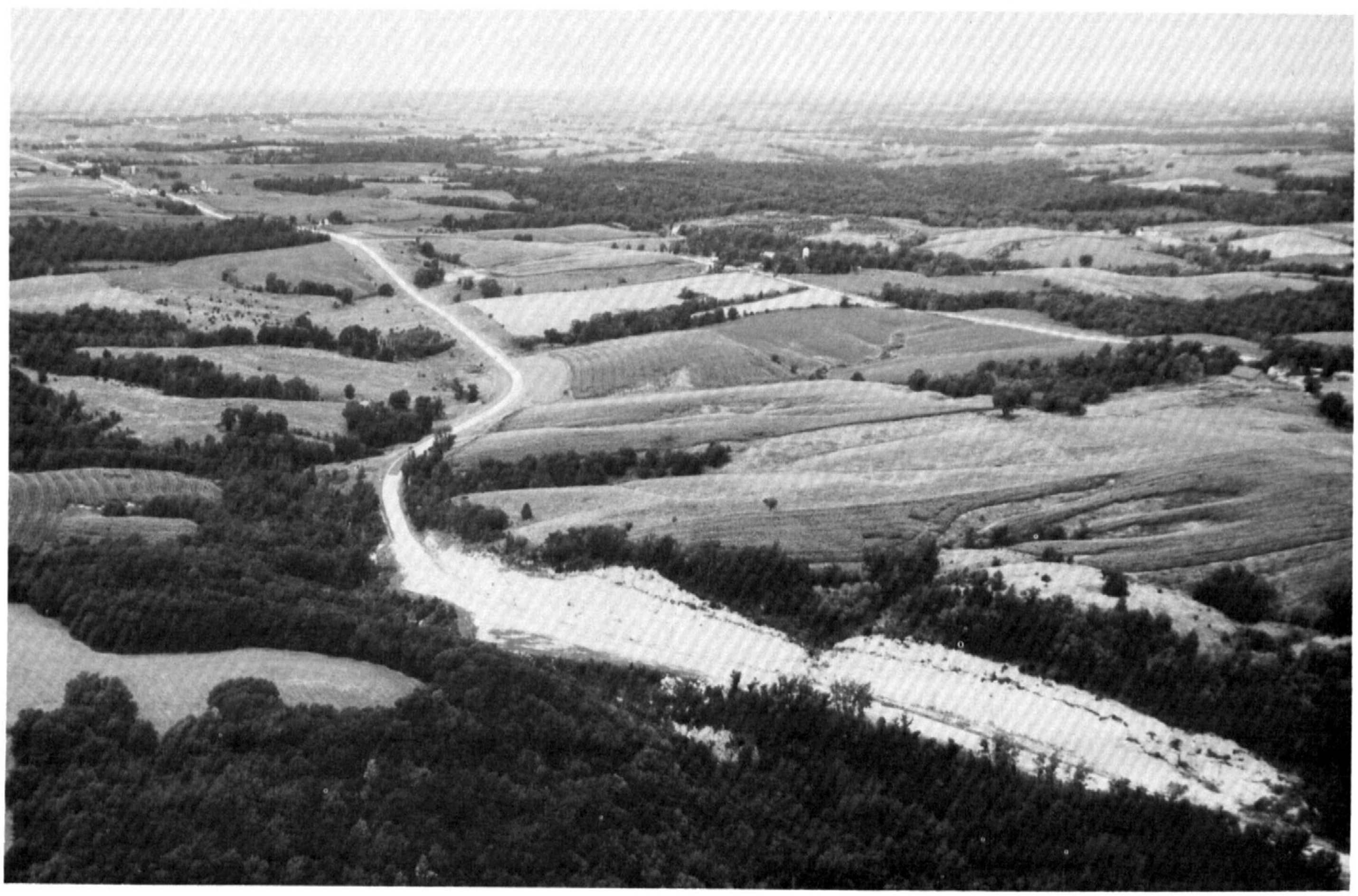


Figure 7.—An area of Dorchester silt loam, 0 to 2 percent slopes, below rock outcrop exposed by a road cut.

Diversion terraces are needed in some cropped areas to prevent the deposition of new sediments. The need for protection from floodwater varies from area to area because the pattern of stream overflow was modified when stream channels were deepened and straightened and roads and road ditches were constructed.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately well suited to most hardwoods. Because it is subject to flooding, it remains wet for moderately long periods after heavy rainfall. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIw.

159—Finchford loamy sand, 0 to 2 percent slopes. This nearly level, excessively drained soil is on alluvial terraces. Areas are irregularly shaped and somewhat elongated and range from 2 to 60 acres in size.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsoil is very friable loamy sand about 19 inches thick. The upper part is brown, and the lower part is strong brown. The substratum to a depth of about 60 inches is brown and strong brown gravelly loamy sand.

Permeability is very rapid, and runoff is slow. Available water capacity is low. The content of organic matter in the surface layer is about 1.0 to 1.5 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil typically is slightly acid or medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content. It seldom crusts after hard rains or puddles if tilled when wet.

Many areas are used for hay and pasture. A few of the larger areas are cultivated. Many small areas are cropped along with larger areas of adjacent soils that are well suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay or pasture. Droughtiness is a severe limitation in most years unless rainfall is timely. Also, soil blowing is a hazard during most years. Areas on alluvial benches could be irrigated easily because they are nearly level and commonly are near an adequate water supply. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss and conserve moisture during periods of low humidity and high velocity winds. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the available water capacity.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

The land capability classification is IVs.

159C—Finchford loamy sand, 2 to 9 percent slopes. This gently sloping and moderately sloping, excessively drained soil is on escarpments on alluvial terraces. Slopes are short. Areas are irregularly shaped and elongated and range from 2 to 20 acres in size.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsurface layer is very dark grayish brown loamy sand about 7 inches thick. The subsoil is about 19 inches thick. The upper part is brown, very friable loamy sand; the next part is dark yellowish brown, loose gravelly loamy sand; and the lower part is strong brown, very friable gravelly loamy sand. The substratum to a depth of about 60 inches is brown and strong brown gravelly sand.

Permeability is very rapid, and runoff is slow. Available water capacity is low. The content of organic matter in the surface layer is about 1.0 to 1.5 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil typically is slightly acid or medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content. It seldom crusts after hard rains or puddles if tilled when wet.

Most areas are used for pasture. A few small areas are cropped along with larger areas of adjacent soils that are well suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses or legumes for hay or pasture. Droughtiness is a severe limitation in most years unless rainfall is timely. If cultivated crops are grown, soil blowing is a hazard. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the available water capacity.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

The land capability classification is IVs.

162B—Downs silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on narrow ridges in the uplands. Areas are irregularly shaped and range from 10 to 80 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 30 inches thick. It is friable. The upper part is brown silt loam, the next part is dark yellowish brown silty clay loam, and the lower part is yellowish brown silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the surface layer is thicker, darker, and higher in content of organic matter.

Permeability is moderate, and runoff is medium in cultivated areas. Available water capacity is high or very high. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction typically is slightly acid or neutral in the surface soil and medium acid or strongly acid in the subsoil. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. Slopes generally are long enough and uniform enough for terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIe.

162C—Downs silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on narrow ridges and long, convex side slopes in the uplands. Areas are irregularly shaped and range from 10 to 80 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 30 inches thick. It is friable. The upper part is brown silt loam, the next part is dark yellowish brown silty clay loam, and the lower part is yellowish brown silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the surface layer is mixed with brown subsoil material.

Permeability is moderate, and runoff is medium in cultivated areas. Available water capacity is high or very high. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction typically is slightly acid or neutral in the surface soil and strongly acid in the subsoil. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate and the likelihood of puddling. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas support native hardwoods. This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

162C2—Downs silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on narrow ridges and long, convex side slopes in the uplands. Areas are irregularly shaped and range from 10 to more than 80 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. Plowing has mixed some streaks and pockets of dark yellowish brown silt loam subsoil material into the surface layer. The subsoil is about 30 inches thick. It is friable. The upper part is dark yellowish brown silt loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In some places the surface layer is brown silty clay loam. In other places it is very dark brown silt loam.

Permeability is moderate, and runoff is medium in cultivated areas. Available water capacity is high or very high. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically is neutral in the surface layer and strongly acid in the upper part of the subsoil. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated (fig. 8). This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

162D—Downs silt loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on long, convex side slopes in the uplands. Areas are irregularly shaped and are 5 to 10 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 30 inches thick. It is friable. The upper part is brown silt loam, the next part is dark yellowish brown silty clay loam, and the lower part is yellowish brown silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the surface layer is mixed with brown subsoil material.

Permeability is moderate, and runoff is medium or rapid in cultivated areas. Available water capacity is high or very high. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction typically is slightly acid or neutral in the surface soil and strongly

Figure 8.—A cultivated area of Downs silt loam, 5 to 9 percent slopes, moderately eroded. Colo and Ely soils are in the grassed waterway.

acid in the upper part of the subsoil. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas have been cleared of trees and are cultivated. A few areas are used for pasture. This soil is suited to corn and soybeans occasionally grown in rotation with small grain. It also is suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas support native hardwoods. This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

162D2—Downs silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on long, convex side slopes in the uplands. Areas are elongated and range from 10 to 30 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. Plowing has mixed some streaks and pockets of dark yellowish brown silty clay loam subsoil material into the surface layer. The subsoil is about 28 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In some areas the surface layer is brown silty clay loam.

Permeability is moderate, and runoff is rapid. Available water capacity is high or very high. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically is slightly acid or neutral in the surface layer and strongly acid in the subsoil. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet. The puddling and crusting increase the runoff rate and retard plant growth.

Most areas are cultivated. This soil is suited to corn and soybeans occasionally grown in rotation with small grain. It also is suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

163C—Fayette silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on narrow ridges and long, convex side slopes in the uplands. Areas are irregularly shaped and range from 10 to 50 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is grayish brown, friable silt loam about 7 inches thick. The subsoil is about 39 inches thick. It is friable. The upper part is brown silt loam, the next part is dark yellowish brown silty clay loam, and the lower part is yellowish brown silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In some places the surface layer is dark grayish brown silt loam about 7 inches thick. In other places it is mixed with brown subsoil material.

Permeability is moderate, and runoff is medium in cultivated areas. Available water capacity is high or very high. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically is slightly acid or medium acid in the surface layer and medium acid or strongly acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

163C2—Fayette silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on narrow ridges and long, convex side slopes in the uplands. Areas are irregularly shaped and range from 20 to more than 80 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. Plowing has mixed some streaks and pockets of brown silty clay loam subsoil material into the surface layer. The subsoil is about 36 inches thick. It is friable. The upper part is brown silty clay loam, the next part is dark yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the surface layer is brown silty clay loam.

Permeability is moderate, and runoff is medium or rapid in cultivated areas. Available water capacity is high or very high. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. Reaction typically is slightly acid or medium acid in the surface layer and medium acid or strongly acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

163D—Fayette silt loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on long, convex side slopes and narrow ridges in the uplands. Areas are elongated and range from 10 to 40 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 8 inches thick. The subsoil is about 34 inches thick. It is friable. The upper part is dark yellowish brown silt loam, and the lower part is yellowish brown silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

Included with this soil in mapping are small areas of Lindley soils on the lower parts of the side slopes. These soils are moderately slowly permeable. They make up less than 5 percent of the unit.

Permeability is moderate in the Fayette soil. Runoff is rapid in cultivated areas. Available water capacity is high or very high. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically is slightly acid or medium acid in the surface layer and medium acid or strongly acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are wooded or are used as permanent pasture. A few have been cleared of trees and are cultivated. This soil is suited to corn and soybeans grown in rotation with small grain. It also is suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss (fig. 9). Slopes commonly are long enough and uniform enough for terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

Figure 9.—Stripcropping and grassed waterways in an area of Fayette silt loam, 9 to 14 percent slopes.

163D2—Fayette silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on narrow ridges and long, convex side slopes in the uplands. Areas are elongated and range from 10 to 40 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. Plowing has mixed some streaks and pockets of dark yellowish brown silty clay loam subsoil material into the surface layer. The subsoil is about 33 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the subsoil has less clay and is grayer.

Included with this soil in mapping are small areas of severely eroded Fayette soils, which make up less than 10 percent of the unit. These soils are on the convex side slopes. They have a lower content of organic matter than this Fayette soil. Also, tilth is poorer.

Permeability is moderate in the Fayette soil, and runoff is rapid. Available water capacity is high or very high. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. Reaction typically is slightly acid or medium acid in the surface layer and medium acid or strongly acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet. The puddling and crusting increase the runoff rate and retard plant growth.

Most areas are cultivated. A few are used for pasture. This soil is suited to row crops occasionally grown in rotation with small grain. It also is suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour stripcropping, and grassed waterways help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

163D3—Fayette silty clay loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, well drained soil is on short, convex side slopes in the uplands. Areas are elongated and range from 5 to 20 acres in size.

Typically, the surface layer is brown silty clay loam about 8 inches thick. Streaks and pockets of grayish brown silt loam surface soil material make up 10 to 15 percent of the surface layer. The subsoil is about 32 inches thick. It is yellowish brown and friable. The upper part is silty clay loam, and the lower part is silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the surface layer is mixed dark grayish brown and brown silt loam.

Permeability is moderate, and runoff is rapid. Available water capacity is high. The content of organic matter in the surface layer is less than 0.5 percent. Reaction typically is medium acid in the surface layer and medium acid or strongly acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is suited to row crops occasionally grown in rotation with small grain. It also is suited to grasses and legumes for hay and pasture. It is best suited to hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. In a few areas slopes are long enough and uniform enough for terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen generally is needed on this soil than on less eroded Fayette soils. Also, more intensive management is needed to maintain productivity and improve tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedling mortality and the hazard or limitations that affect planting or harvesting are slight.

The land capability classification is IVe.

163E—Fayette silt loam, 14 to 18 percent slopes. This moderately steep, well drained soil is on long, convex side slopes in the uplands. Areas are elongated and range from 10 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 34 inches thick. It is friable. The upper part is dark yellowish brown silt loam, and the lower part is yellowish brown silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

Included with this soil in mapping are small areas of Lindley soils. These soils are moderately slowly permeable and are on the lower parts of the side slopes. They make up less than 5 percent of the unit.

Permeability is moderate in the Fayette soil. Runoff is rapid in cultivated areas. Available water capacity is high or very high. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically is slightly acid or medium acid in the surface layer and medium acid or strongly acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas support native hardwoods. Some are used as permanent pasture. This soil is suited to row crops occasionally grown in rotation with small grain. It also is suited to grasses and legumes for hay and pasture. It is best suited to hay and pasture. Corn and soybeans are grown only to establish legumes. If cultivated crops are grown, erosion is a serious hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. The hazard of erosion and the equipment limitation are moderate. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed in operating this equipment.

The land capability classification is IVe.

163E2—Fayette silt loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is on short, convex side slopes in the uplands. Areas are elongated and range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. Plowing has mixed some streaks and pockets of silty clay loam subsoil material into the surface layer. The subsoil is about 33 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the surface layer is brown silty clay loam.

Included with this soil in mapping are some small areas of Dubuque and Nordness soils on the lower parts of the side slopes. Dubuque soils are underlain by limestone bedrock at a depth of 20 to 30 inches. Nordness soils are underlain by limestone bedrock at a depth of 8 to 20 inches. Included soils make up less than 10 percent of the unit.

Permeability is moderate in the Fayette soil. Runoff is rapid in cultivated areas. Available water capacity is high or very high. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. Reaction typically is slightly acid or medium acid in the surface layer and medium acid or strongly acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet. The puddling and crusting increase the runoff rate and retard plant growth.

Many areas are cultivated. A few are used for pasture. This soil is suited to row crops occasionally grown in rotation with small grain. It also is suited to grasses and legumes for hay and pasture. It is best suited to hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. The hazard of erosion and the equipment limitation are moderate. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed in operating this equipment.

The land capability classification is IVe.

163E3—Fayette silty clay loam, 14 to 18 percent slopes, severely eroded. This moderately steep, well drained soil is on short, convex side slopes on uplands dissected by gullies and waterways. Areas are elongated and are 5 to 10 acres in size.

Typically, the surface layer is brown silty clay loam about 8 inches thick. Streaks and pockets of grayish brown silt loam surface soil material make up 10 to 15 percent of the surface layer. The subsoil is about 30 inches thick. It is yellowish brown and friable. The upper part is silty clay loam, and the lower part is silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the surface layer is mixed dark grayish brown and brown silt loam.

Included with this soil in mapping are small areas of Lindley soils on the lower parts of the side slopes. These soils are moderately slowly permeable. They make up less than 5 percent of the unit.

Permeability is moderate in the Fayette soil, and runoff is rapid. Available water capacity is high. The content of organic matter in the surface layer is less than 0.5 percent. Reaction typically is medium acid in the surface layer and medium acid or strongly acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet. The puddling and crusting increase the runoff rate and retard plant growth.

Many areas are cultivated. Some are used as permanent pasture. This soil generally is unsuitable for cultivated crops because of a serious hazard of further erosion. Cultivated crops should be grown only to reestablish grasses and legumes for hay and pasture. More nitrogen generally is needed on this soil than on less eroded Fayette soils. Also, more intensive management is needed to improve productivity and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in fairly good condition.

This soil is moderately well suited to trees. The hazard of erosion and the equipment limitation are moderate. Carefully selecting sites for logging trails and roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed in operating this equipment.

The land capability classification is VIe.

163F—Fayette silt loam, 18 to 25 percent slopes. This steep, well drained soil is on short, convex side slopes in the uplands. Areas are elongated and range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 8 inches thick. The subsoil is about 36 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

Included with this soil in mapping are small areas of Dubuque and Nordness soils on the lower parts of the side slopes. Dubuque soils are 20 to 30 inches deep over limestone bedrock. Nordness soils are 8 to 20 inches deep over limestone bedrock. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Fayette soil, and runoff is rapid. Available water capacity is high or very high. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically is slightly acid or medium acid in the surface layer and medium acid or strongly acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas support native hardwoods. Some are used as permanent pasture. This soil generally is unsuitable for cultivated crops because of the steep slope and a severe erosion hazard. It is only moderately well suited to hay. Operating farm machinery is difficult because of the slope and because of gullies and waterways.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. The hazard of erosion and the equipment limitation are moderate. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed in operating this equipment.

The land capability classification is VIe.

163F2—Fayette silt loam, 18 to 25 percent slopes, moderately eroded. This steep, well drained soil is on short, convex side slopes in the uplands. Areas are elongated and range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. Plowing has mixed some streaks and pockets of dark yellowish brown silty clay loam subsoil material into the surface layer. The subsoil is about 33 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the surface layer is brown silty clay loam.

Included with this soil in mapping are small areas of Dubuque and Nordness soils on the lower parts of the side slopes. Dubuque soils are 20 to 30 inches deep over limestone bedrock. Nordness soils are 8 to 20 inches deep over limestone bedrock. Included soils make up about 6 to 10 percent of the unit.

Permeability is moderate in the Fayette soil. Runoff is rapid in cultivated areas. Available water capacity is high or very high. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. Reaction typically is slightly acid or medium acid in the surface layer and medium acid or strongly acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet. The puddling and crusting increase the runoff rate and retard plant growth.

Many areas are cultivated. Some are used for pasture. This soil generally is unsuitable for cultivated crops because of the steep slope and a severe erosion hazard. It is only moderately well suited to hay. Operating farm machinery is difficult because of the slope and because of gullies and waterways. Cultivated crops should be grown only to reestablish grasses and legumes for hay and pasture.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in fairly good condition.

This soil is moderately well suited to trees. The hazard of erosion and the equipment limitation are moderate. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed in operating this equipment.

The land capability classification is VIe.

163F3—Fayette silty clay loam, 18 to 25 percent slopes, severely eroded. This steep, well drained soil is on short, convex side slopes on uplands dissected by gullies and waterways. Areas are elongated and are 5 to 10 acres in size.

Typically, the surface layer is brown silty clay loam about 8 inches thick. Streaks and pockets of grayish brown silt loam surface soil material make up 5 to 15 percent of the surface layer. The subsoil is about 30 inches thick. It is yellowish brown and friable. The upper part is silty clay loam, the next part is silt loam, and the lower part is silt loam and mottled. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the surface layer is dark grayish brown and brown silt loam.

Included with this soil in mapping are small areas of Lindley soils on the lower parts of the side slopes. These soils are moderately slowly permeable. They make up less than 10 percent of the unit.

Permeability is moderate in the Fayette soil, and runoff is rapid. Available water capacity is high. The content of organic matter in the surface layer is less than 0.5 percent. Reaction typically is medium acid in the surface layer and medium acid or strongly acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet. The crusting and puddling increase the runoff rate and retard plant growth.

Many areas are cultivated. Some are used as permanent pasture. This soil generally is unsuitable for cultivated crops because of the steep slope and a severe erosion hazard. It is only moderately well suited to hay. Operating farm machinery is difficult because of the slope and the gullies and waterways. Cultivated crops should be grown only to reestablish grasses and legumes for hay and pasture.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in fairly good condition.

This soil is moderately well suited to trees. The hazard of erosion and the equipment limitation are moderate. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed in operating this equipment.

The land capability classification is VIe.

163G—Fayette silt loam, 25 to 40 percent slopes. This very steep, well drained soil is on short, convex side slopes in the uplands. Areas are elongated and range from 5 to 20 acres in size.

Typically, the surface layer is very dark gray silt loam about 2 inches thick. The subsurface layer is brown and dark grayish brown silt loam about 6 inches thick. The subsoil is about 34 inches thick. It is friable. The upper part is brown silty clay loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

Included with this soil in mapping are small areas of Nordness soils. These soils are 8 to 20 inches deep over limestone bedrock. They make up less than 10 percent of the unit.

Permeability is moderate in the Fayette soil, and runoff is rapid. Available water capacity is high or very high. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically is slightly acid or medium acid in the surface layer and medium acid or strongly acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium.

Nearly all areas are wooded or used as permanent pasture. This soil generally is unsuitable for cultivated crops or for hay because of the very steep slope and a severe erosion hazard. It is poorly suited to pasture. Ordinary farm machinery cannot be used because of the very steep slope.

Most areas support native hardwoods. This soil is moderately well suited to trees. The hazard of erosion and the equipment limitation are moderate. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed in operating this equipment.

The land capability classification is VIIe.

171B—Bassett loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on uplands. Areas are irregularly shaped and range from 10 to 50 acres in size.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsurface layer is dark grayish brown loam about 6 inches thick. The subsoil is loam about 37 inches thick. The upper part is brown and friable, and the lower part is yellowish brown, mottled, and firm. The substratum to a depth of about 60 inches is mottled strong brown and grayish brown loam. In places the surface layer is very dark grayish brown sandy loam.

Included with this soil in mapping are small areas of soils that have clayey material at a depth of 2 to 4 feet. Water tends to perch on the clayey layer, causing hillside seepage and wetness. These soils are on the lower parts of the landscape. They make up less than 5 percent of the unit.

Permeability is moderate in the Bassett soil, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction varies widely in the surface layer as a result of local liming practices. It is strongly acid at a depth of about 30 inches. The subsoil has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses or legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some small areas support native hardwoods. This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIe.

171C2—Bassett loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on convex side slopes in the uplands. Areas are irregularly shaped and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown and brown loam about 6 inches thick. Plowing has mixed some streaks and pockets of brown loam subsoil material into the surface layer. The subsoil is loam about 36 inches thick. The upper part is brown and friable, the next part is yellowish brown and firm, and the lower part is yellowish brown, mottled, and firm. The substratum to a depth of about 60 inches is mottled strong brown and grayish brown loam.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 1.5 to 2.0 percent. Reaction varies widely in the surface layer as a result of local liming practices. It is strongly acid at a depth of about 30 inches. The subsoil has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses or legumes for hay or pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen generally is needed on this soil than on Bassett soils that are less eroded. Also, more intensive management is needed to maintain productivity and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some small areas support native hardwoods. This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

174B—Bolan loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex ridgetops and side slopes in the uplands. Areas are irregularly shaped and range from 5 to more than 100 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is dark brown and very dark brown loam about 12 inches thick. The subsoil is about 21 inches thick. It is friable. The upper part is brown loam, and the lower part is dark yellowish brown fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown loamy fine sand and fine sand.

Included with this soil in mapping are small areas of the somewhat excessively drained Dickinson soils. These soils are in positions on the landscape similar to those of the Bolan soil. They make up less than 5 percent of the unit.

Permeability is moderate in the upper part of the Bolan soil and rapid in the lower part. Runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 3 to 4 percent. Reaction typically is medium acid in the subsoil and varies widely in the surface layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It can be droughty during years of below normal rainfall. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. If terraces are constructed, cuts should not expose the underlying loamy fine sand and fine sand. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

174C—Bolan loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex ridgetops and side slopes in the uplands. Areas are irregularly shaped and range from 2 to 40 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is dark brown and very dark brown loam about 8 inches thick. The subsoil is about 21 inches thick. It is friable. The upper part is brown loam, and the lower part is dark yellowish brown fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown loamy fine sand and fine sand. In places the surface layer is mixed very dark brown and brown loam.

Included with this soil in mapping are small areas of the somewhat excessively drained Dickinson and excessively drained Sparta soils. These soils are in positions on the landscape similar to those of the Bolan soil. They make up less than 5 percent of the unit.

Permeability is moderate in the upper part of the Bolan soil and rapid in the lower part. Runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction is medium acid in the subsoil and varies widely in the surface layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It can be droughty during years of below normal rainfall. If cultivated crops are grown, erosion is a moderate hazard. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. If terraces are constructed, cuts should not expose the underlying loamy fine sand and fine sand. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

175—Dickinson fine sandy loam, 0 to 2 percent slopes. This nearly level, somewhat excessively drained soil is on alluvial terraces and on uplands. Areas are irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer also is very dark brown fine sandy loam. It is about 12 inches thick. The subsoil is about 21 inches thick. It is very friable. The upper part is dark brown and dark yellowish brown fine sandy loam, and the lower part is yellowish brown loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown loamy sand. In places the surface layer is dark brown gravelly loamy sand.

Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Runoff is slow. Available water capacity is low. The content of organic matter in the surface layer is about 1.5 to 2.0 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid or strongly acid. It has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. Many small areas are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. Also, soil blowing is a hazard during most years. Areas on alluvial benches could be irrigated easily because they are nearly level and commonly are near an adequate water supply. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss and conserve moisture during periods of low humidity and high velocity winds. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the available water capacity.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet or too dry reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

The land capability classification is IIs.

175B—Dickinson fine sandy loam, 2 to 5 percent slopes. This gently sloping, somewhat excessively drained soil is on glaciated uplands and alluvial terraces. Areas are irregularly shaped or oval and range from 2 to 60 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown fine sandy loam about 12 inches thick. The subsoil is about 21 inches thick. It is very friable. The upper part is dark brown and dark yellowish brown fine sandy loam, and the lower part is yellowish brown loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown loamy sand. In places the surface layer is dark brown gravelly loamy sand.

Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 1.0 to 1.5 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid or strongly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some of the larger areas are used for pasture or hay. Many small areas are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. Also, soil blowing is a hazard in areas where cultivated crops are grown. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface, cover crops, and grassed waterways help to prevent excessive soil loss. The soil is poorly suited to terracing because ridging the moderately coarse textured material is difficult and because the underlying coarse textured material is too close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the available water capacity.

If this soil is used for pasture, overgrazing reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during excessively wet or dry periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

175C—Dickinson fine sandy loam, 5 to 9 percent slopes. This moderately sloping, somewhat excessively drained soil is on convex ridgetops and side slopes in the uplands. Areas are irregularly shaped and range from 5 to 20 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown fine sandy loam about 10 inches thick. The subsoil is about 19 inches thick. It is very friable. The upper part is dark brown and dark yellowish brown fine sandy loam, and the lower part is yellowish brown loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown loamy sand. In places the surface layer is dark brown gravelly loamy sand.

Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 1.0 to 1.5 percent. Reaction typically is medium acid or strongly acid in the subsoil and varies widely in the surface layer as a result of local liming practices. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some of the larger areas are used for hay or pasture. This soil is suited to corn, soybeans, and small grain. It is well suited to grasses or legumes for hay or pasture. If cultivated crops are grown, soil blowing and water erosion are hazards. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface, cover crops, and grassed waterways help to prevent excessive soil loss. The soil is poorly suited to terracing because ridging the moderately coarse textured material is difficult and because the underlying coarse textured material is too close to the surface. If terraces are built, cuts should not expose the coarse textured material in the terrace channels. Droughtiness is a limitation in most years unless rainfall is timely. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the available water capacity.

A cover of pasture plants or hay is effective in controlling water erosion and soil blowing. Pastures can be improved by renovating and reseeding. Overgrazing reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

177—Saude loam, 0 to 2 percent slopes. This nearly level, well drained soil is on alluvial terraces. Areas are irregularly shaped and range from 2 to 80 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is very dark brown loam about 6 inches thick. The subsoil is about 16 inches thick. It is friable. The upper part is dark brown and dark yellowish brown loam, and the lower part is dark yellowish brown sandy loam. The substratum to a depth of about 60 inches is yellowish brown gravelly coarse sand.

Permeability is moderate in the subsoil and very rapid in the substratum. Runoff is slow. Available water capacity is low. The content of organic matter in the surface layer is about 3 to 4 percent. The underlying sand and gravel somewhat limit the depth to which the roots of some crops penetrate. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid or strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. This soil is moderately suited to corn, soybeans, and small grain and to grasses or legumes for hay or pasture. Droughtiness is a limitation in most years unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIs.

177B—Saude loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on alluvial terraces. Areas are irregularly shaped and somewhat elongated and range from 2 to 10 acres in size.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsoil is about 16 inches thick. The upper part is dark brown and dark yellowish brown, friable loam, and the lower part is dark yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown gravelly coarse sand. In places the surface layer is loamy sand.

Permeability is moderate in the subsoil and very rapid in the substratum. Runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 2 to 3 percent. The underlying sand and gravel somewhat limit the depth to which the roots of some crops penetrate. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid or strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. The soil is poorly suited to terracing because the coarse textured material is too close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. Droughtiness is a limitation in most years unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

178—Waukee loam, 0 to 2 percent slopes. This nearly level, well drained soil is on alluvial terraces. Areas are irregularly shaped and range from 10 to 50 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 14 inches thick. The subsoil is about 20 inches thick. The upper part is dark brown and dark yellowish brown friable loam, and the lower part is yellowish brown, very friable gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown sand and gravel. In places the surface layer is gravelly sandy loam.

Permeability is moderate in the subsoil and very rapid in the substratum. Runoff is slow. Available water capacity is moderate. The content of organic matter in the surface layer is about 3 to 4 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid. It generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIs.

178B—Waukee loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on alluvial terraces. Areas are irregularly shaped and range from 10 to 50 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 14 inches thick. The subsoil is about 20 inches thick. The upper part is dark brown, friable loam; the next part is dark yellowish brown, friable loam; and the lower part is yellowish brown, very friable gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In places the surface layer is gravelly loamy sand.

Permeability is moderate in the subsoil and very rapid in the substratum. Runoff is slow. Available water capacity is moderate. The content of organic matter in the surface layer is about 3 to 4 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

183C—Dubuque silt loam, 20 to 30 inches to limestone, 5 to 9 percent slopes. This moderately sloping, moderately deep, well drained soil is on narrow ridges and side slopes in the uplands. Areas are elongated and range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 20 inches thick. The upper part is brown, friable silt loam; the next part is yellowish brown, friable silty clay loam; and the lower part is brown, firm clay. Hard limestone bedrock is at a depth of about 28 inches.

Included with this soil in mapping are small areas where the depth to limestone bedrock is 30 to 40 inches. These areas are near the center of the ridges. They make up about 5 percent of the unit.

Permeability is moderate in the upper part of the Dubuque soil and slow in the lower part. Runoff is medium or rapid. Available water capacity is low. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically is slightly acid in the surface soil and strongly acid in the subsoil. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are wooded or are used as permanent pasture. A few are cultivated. This soil is suited to occasionally grown cultivated crops. If cultivated crops are grown, erosion is a hazard. Soil loss through erosion adversely affects cropping by decreasing the depth to limestone. A scarcity of moisture is likely to damage crops unless rainfall is timely during the growing season. A system of conservation tillage that leaves crop residue on the surface, stripcropping, and grassed waterways help to prevent excessive soil loss. The soil is not well suited to terracing because the bedrock may interfere with construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight. The penetration of tree roots may be limited by the limestone bedrock.

The land capability classification is IIIe.

183E—Dubuque silt loam, 20 to 30 inches to limestone, 14 to 18 percent slopes. This moderately steep, moderately deep, well drained soil is on short, convex side slopes in the uplands. Areas are elongated and range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsoil is about 14 inches thick. The upper part is brown, friable silt loam; the next part is yellowish brown, friable silty clay loam; and the lower part is brown, very firm clay. Fractured limestone bedrock is at a depth of about 22 inches.

Included with this soil in mapping are small areas of Nordness soils on the lower parts of the side slopes. These soils are 8 to 20 inches deep over limestone bedrock. They make up less than 10 percent of the unit.

Permeability is moderate in the upper part of the Dubuque soil and slow in the lower part. Runoff is rapid. Available water capacity is low. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically is slightly acid in the surface soil and strongly acid in the subsoil. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled.

Most areas are wooded or are used as permanent pasture. This soil generally is unsuitable for cultivated crops because of the moderately steep slope and a severe erosion hazard. It is only moderately well suited to hay. If cultivated crops are grown, erosion is a severe hazard. Cultivated crops should be grown only to reestablish pasture. Soil loss through erosion adversely affects cropping by decreasing the depth to limestone.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is moderately well suited to trees. The hazard of erosion and the equipment limitation are moderate. The penetration of tree roots may be limited by the limestone bedrock. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed in operating this equipment.

The land capability classification is VIe.

198B—Floyd loam, 1 to 4 percent slopes. This gently sloping, somewhat poorly drained soil is on concave slopes and on side slopes along upland drainageways. Areas are irregularly shaped and range from 2 to 40 acres in size.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is black and very dark brown loam about 13 inches thick. The subsoil is about 35 inches thick. It is mottled. The upper part is dark grayish brown, friable loam; the next part is olive brown and light olive brown, friable sandy loam and firm loam; and the lower part is grayish brown, firm loam. The substratum to a depth of about 60 inches is grayish brown, mottled loam. In places the surface soil is thinner and lighter colored.

Permeability is moderate and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 7 percent. The soil typically is neutral or slightly acid throughout. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Inadequately drained areas generally are used for pasture. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Gully erosion is a hazard in areas of concentrated runoff. Measures that help to control runoff from the higher elevations are needed. A combination of terraces and drainage tile is needed in some areas both to control erosion and to reduce the wetness. Glacial stones and boulders are common in many unimproved, undrained areas. They should be removed before the soil is tile drained and cultivated. Installing tile is difficult in some areas because of the very friable, water-bearing erosional sediments. Tiling this soil may leave rock fragments of cobble size on the surface. These cobbles are from the stone line at the boundary between the loamy sediments and the underlying glacial till. They can hinder tillage if left on the surface. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

205B—Whalan loam, 30 to 40 inches to limestone, 2 to 5 percent slopes. This gently sloping, moderately deep, well drained soil is on uplands. Areas are irregularly shaped or round and range from 3 to 10 acres in size.

Typically, the surface layer is very dark grayish brown loam about 4 inches thick. The subsurface layer is dark grayish brown loam about 7 inches thick. The subsoil is about 23 inches thick. The upper part is brown, friable loam; the next part is yellowish brown, firm clay loam; and the lower part is brown and strong brown, very firm clay. Fractured limestone bedrock is at a depth of about 34 inches.

Included with this soil in mapping are small areas where limestone bedrock is exposed. The exposed limestone interferes with tillage. These areas are in positions on the landscape similar to those of the Whalan soil. They make up less than 5 percent of the unit.

Permeability is moderate in the Whalan soil, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 1 percent. The shrink-swell potential is high in the lower part of the subsoil. The root zone is limited by the limestone bedrock. Reaction typically is medium acid in the upper part of the subsoil and strongly acid in the lower part. It varies widely in the surface layer as a result of local liming practices. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses or legumes for hay or pasture. Droughtiness is a limitation during periods of below normal rainfall. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and contour farming help to prevent excessive soil loss and conserve moisture during periods of low rainfall. If terraces are constructed, cuts should not expose the underlying bedrock. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas support native hardwoods. This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIe.

207B—Whalan loam, 20 to 30 inches to limestone, 2 to 5 percent slopes. This gently sloping, moderately deep, well drained soil is on uplands. Areas are irregularly shaped and range from 4 to 25 acres in size.

Typically, the surface layer is very dark grayish brown loam about 4 inches thick. The subsurface layer is dark grayish brown loam about 7 inches thick. The subsoil is about 15 inches thick. The upper part is brown, friable loam; the next part is yellowish brown, firm clay loam; and the lower part is yellowish red and strong brown, very firm clay. Fractured limestone bedrock is at a depth of about 26 inches.

Permeability is moderate, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 1 percent. The shrink-swell potential is high in the lower part of the subsoil. The root zone is limited by the limestone bedrock. Reaction typically is medium acid in the upper part of the subsoil and strongly acid in the lower part. It varies widely in the surface layer as a result of local liming practices. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Some areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses or legumes for hay or pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and contour farming help to prevent excessive soil loss. The soil is poorly suited to terracing because the limestone bedrock is too close to the surface. If terraces are built, cuts should not expose the bedrock in terrace channels. Droughtiness is a limitation in most years unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas support native hardwoods. This soil is moderately suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIe.

207C—Whalan loam, 20 to 30 inches to limestone, 5 to 9 percent slopes. This moderately sloping, moderately deep, well drained soil is on convex side slopes in the uplands. Areas are irregularly shaped and range from 3 to 20 acres in size.

Typically, the surface layer is very dark grayish brown loam about 4 inches thick. The subsurface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is brown, friable loam; the next part is yellowish brown, firm clay loam; and the lower part is yellowish red and strong brown, very firm clay. Fractured limestone bedrock is at a depth of about 24 inches.

Permeability is moderate, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. The shrink-swell potential is high in the lower part of the subsoil. The root zone is limited by the limestone bedrock. Reaction typically is medium acid in the upper part of the subsoil and strongly acid in the lower part. It varies widely in the surface layer as a result of local liming practices. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Some areas are cultivated. Most of the larger areas are used for pasture. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and contour farming help to prevent excessive soil loss. The soil is poorly suited to terracing because the limestone bedrock is too close to the surface. If terraces are built, cuts should not expose the bedrock in terrace channels. Droughtiness is a limitation in most years unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is moderately suited to trees. Tree growth and production may be limited by the low available water capacity. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

213B—Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes. This gently sloping, moderately deep, well drained soil is on convex ridges and side slopes on uplands and escarpments. Areas are irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is very dark grayish brown loam about 11 inches thick. The subsoil is about 21 inches thick. It is brown. The upper part is friable loam, and the lower part is firm silty clay. Fractured limestone bedrock is at a depth of about 39 inches. In some places rinds of dark brown residuum are on the limestone fragments in the upper part of the bedrock. In other places sandy loam is in the surface soil or subsoil.

Permeability is moderate, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 3 to 4 percent. The root zone is limited by the limestone bedrock. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses or legumes for hay or pasture. If cultivated crops are grown, erosion is a hazard. Droughtiness is a limitation during periods of below normal rainfall. A system of conservation tillage that leaves crop residue on the surface, terraces, and contour farming help to prevent excessive soil loss and conserve moisture during periods of low rainfall. If terraces are constructed, cuts should not expose the underlying bedrock. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

214B—Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes. This gently sloping, moderately deep, well drained soil is on uplands. Areas are irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 12 inches thick. It is brown. The upper part is friable loam, and the lower part is firm silty clay. Fractured limestone bedrock is at a depth of about 28 inches. In some places rinds of dark brown residuum are on the limestone fragments in the upper part of the bedrock. In other places the soil is somewhat excessively drained.

Permeability is moderate, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 3 to 4 percent. The root zone is limited by the limestone bedrock. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Droughtiness is a limitation in most years unless rainfall is timely. A system of conservation tillage that leaves crop residue on the surface and contour farming help to prevent excessive soil loss and conserve moisture during periods of low rainfall. The soil is poorly suited to terracing because of the moderate depth to limestone. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

215C—Goss loam, 2 to 9 percent slopes. This gently sloping and moderately sloping, well drained and somewhat excessively drained soil is on ridges and side slopes in the uplands. Areas are irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown loam about 4 inches thick. The subsurface layer is dark grayish brown fine sandy loam about 6 inches thick. The subsoil is about 50 inches thick. The upper part is brown, friable loam; the next part is dark red, very firm very cherty clay; and the lower part is red, very firm extremely cherty clay.

Included with this soil in mapping are small areas where cultivation is very difficult because many chert fragments are on the surface. These areas are on the lower parts of the side slopes. They make up about 3 to 8 percent of the unit.

Permeability is moderate in the Goss soil. Runoff is medium in cultivated areas. Available water capacity is low or very low. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. The shrink-swell potential is high in the middle and lower parts of the subsoil. Reaction typically is slightly acid to strongly acid in the subsoil and varies widely in the surface soil as a result of local liming practices. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer cannot be easily tilled because of the chert fragments close to the surface.

Most areas are used for pasture or are wooded. A few are cultivated. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. The chert fragments hinder the construction of terraces. Regularly adding organic material improves fertility and increases the rate of water infiltration.

A cover of pasture plants is effective in controlling erosion. Overgrazing, however, causes surface compaction and increases the runoff rate. The maximum stocking rate is very low. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in fairly good condition.

This soil is poorly suited to trees. It is droughty and has a limited root zone. Seedlings do not survive well. As a result, they should be planted at close intervals. Thinning the stands helps to provide adequate growing space for the surviving trees.

The land capability classification is IVs.

221—Palms muck, 1 to 4 percent slopes. This very gently sloping, very poorly drained soil generally is on foot slopes in the uplands and in broad upland drainageways. In some areas it is on alluvial terraces. It is subject to ponding. Areas are round or elongated and range from 3 to 40 acres in size.

Typically, the surface layer is black muck about 9 inches thick. The subsurface layer also is black muck. It is about 38 inches thick. The substratum to a depth of about 60 inches is very dark gray silt loam.

Permeability is moderately slow to moderately rapid in the organic layers and moderately slow or moderate in the substratum. Runoff is very slow. Available water capacity is very high. The soil has a seasonal high water table. The surface layer is hummocky unless the soil is drained and leveled. Tilth is poor. The content of organic matter in the surface layer is more than 75 percent. Reaction typically is slightly acid in the organic layers. The substratum generally has a very low supply of available phosphorus and potassium.

Most areas are undrained and are left idle. If drained, this soil is moderately suited to corn and soybeans. It is suited to small grain, but oats generally lodge and thus yields are reduced. The soil generally is wet because it is in or near seepy areas or buried springs where water that is frequently under pressure seeps to the surface. Installing an adequate drainage system is difficult. A system that is designed to intercept the seepage water is the most successful. If the soil is tile drained, the organic material settles around the tile. Shrinkage of the organic material can alter tile alignment and cause the drainage system to function improperly. As a result, tile drains should be installed in the mineral substratum. In some areas obtaining suitable outlets is difficult.

This soil is poorly suited to pasture unless it is drained and renovated. The spongy material cannot withstand the traffic of livestock. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition and help to control the growth of undesirable species, such as hedges and willows.

This soil is poorly suited to trees because it has a seasonal high water table and remains wet for long periods after rainfall. Special equipment commonly is needed. Operating this equipment is difficult because of the spongy surface layer. A drainage system is needed to reduce the seedling mortality rate. Harvest methods that do not leave individual trees widely spaced reduce the windthrow hazard.

The land capability classification is IIIw.

225—Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on alluvial terraces. Areas are irregularly shaped and range from 2 to more than 100 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is very dark grayish brown loam about 10 inches thick. The subsoil is mottled, friable loam about 12 inches thick. The upper part is dark grayish brown, and the lower part is dark yellowish brown and yellowish brown. The substratum to a depth of about 60 inches is yellowish brown and brownish yellow sand and gravel.

Included with this soil in mapping are small areas of poorly drained soils in slight depressions. Tillage commonly is delayed unless these soils are drained. These soils make up about 5 to 7 percent of the unit.

Permeability is moderate in the subsoil of the Lawler soil and very rapid in the substratum. Runoff is slow. Available water capacity is low or moderate. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 5 percent. The underlying sand and gravel somewhat limit the depth to which the roots of some crops can penetrate. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid or strongly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses or legumes for hay or pasture. Droughtiness is a limitation during periods of below normal rainfall. The water table is moderately high in the spring but drops rapidly during the growing season. In some areas tile drainage is beneficial during wet periods, but installing the tile is difficult because of the loose, water-bearing sand and gravel. If cultivated areas are plowed in the fall, erosion is a hazard unless the surface is protected. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay improves soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIs.

226—Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on alluvial terraces. Areas are irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is very dark grayish brown loam about 10 inches thick. The subsoil is mottled, friable loam about 17 inches thick. The upper part is dark grayish brown, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is yellowish brown and brownish yellow, stratified sand and gravel.

Included with this soil in mapping are small areas of poorly drained soils in slight depressions. Tillage is delayed in some areas unless these soils are drained. These soils make up less than 5 percent of the unit.

Permeability is moderate in the subsoil of the Lawler soil and very rapid in the substratum. Runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 5 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is dominantly medium acid or strongly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. Fieldwork is more timely in areas that have been fall plowed. Erosion is a hazard, however, unless these areas are protected. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay improves soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIs.

241B—Burkhardt-Saude complex, 2 to 5 percent slopes. These gently sloping, somewhat excessively drained and well drained soils are on convex ridges and side slopes in the uplands. Areas are irregularly shaped and range from 2 to 80 acres in size. They are about 55 percent Burkhardt soil and 35 percent Saude soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Burkhardt soil is very dark grayish brown sandy loam about 7 inches thick. The subsurface layer also is very dark grayish brown sandy loam. It is about 6 inches thick. The subsoil is about 9 inches thick. The upper part is dark brown, very friable sandy loam, and the lower part is brown loamy sand in which the content of gravel is about 10 percent. The upper 11 inches of the substratum is brown sand in which the content of gravel is about 15 percent. The lower part to a depth of about 60 inches is dark yellowish brown coarse sand and gravel.

Typically, the surface layer of the Saude soil is very dark brown loam about 7 inches thick. The subsurface layer is very dark grayish brown loam about 7 inches thick. The subsoil is about 41 inches thick. The upper part is dark yellowish brown and brown, friable loam, and the lower part is brown, very friable gravelly loamy coarse sand that has dark reddish brown mottles. The substratum to a depth of about 60 inches is strong brown and reddish brown loam. In places the soil has no gravel in the subsoil or the substratum.

Included with these soils in mapping are small areas of Dickinson soils. These included soils do not have gravel in the substratum. They are in positions on the landscape similar to those of the Burkhardt and Saude soils. They make up about 10 percent of the unit.

Permeability is moderately rapid in the subsoil of the Burkhardt soil and rapid in the substratum. It is moderate in the subsoil of the Saude soil and very rapid in the substratum. Runoff is medium on both soils. Available water capacity is low or very low in the Burkhardt soil and low in the Saude soil. The content of organic matter in the surface layer of both soils is about 2 to 4 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid or strongly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable or very friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. These soils are poorly suited to corn and soybeans. They are better suited to small grain or to grasses or legumes for hay or pasture. Droughtiness is a limitation in most years unless rainfall is timely. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss and conserves moisture. The soils are poorly suited to terracing because the coarse textured material in the lower part of the subsoil is too close to the surface. If terraces are built, cuts should not expose this coarse material in terrace channels. Returning crop residue to the soils or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration and the available water capacity.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and deterioration of tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soils in good condition.

A few areas are wooded. The Burkhardt soil is moderately suited to trees. It is droughty in most years. Seedlings do not survive well. As a result, they should be planted at close intervals. Thinning the stands helps to provide adequate growing space for the surviving trees.

The land capability classification is IVs.

284—Flagler fine sandy loam, 0 to 2 percent slopes. This nearly level, somewhat excessively drained soil is on alluvial terraces. Areas are irregularly shaped and range from 10 to 40 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 10 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 10 inches thick. The subsoil is about 16 inches thick. It is very friable. The upper part is brown sandy loam, and the lower part is dark yellowish brown gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown coarse sand in which the content of fine gravel is about 15 percent. In places the surface layer is gravelly sandy loam.

Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Runoff is slow. Available water capacity is low. The content of organic matter in the surface layer is about 1.5 to 2.0 percent. The underlying sand and gravel somewhat limit the depth to which the roots of some crops can penetrate. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid or medium acid. It generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. Many small areas are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. Also, soil blowing is a hazard during most years. Some areas could be easily irrigated because they are nearly level and commonly are near an adequate water supply. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss and conserve moisture during periods of low humidity and high velocity winds. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration and the available water capacity. The soil warms up quickly in the spring, thus stimulating early plant growth.

If this soil is used for pasture, overgrazing reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIs.

284B—Flagler fine sandy loam, 2 to 5 percent slopes. This gently sloping, somewhat excessively drained soil is on alluvial terraces. Areas range from 2 to 15 acres in size. They generally are long and narrow, but some are irregularly shaped.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 6 inches thick. The subsoil is about 10 inches thick. It is very friable. The upper part is brown sandy loam, and the lower part is yellowish brown loamy sand that contains some fine gravel. The substratum to a depth of about 60 inches is yellowish brown sand and coarse sand in which the content of fine gravel is about 15 percent.

Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 1 to 2 percent. The underlying sand and gravel somewhat limit the depth to which the roots of some crops can penetrate. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid or medium acid. It generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Many small areas are cropped along with large areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn and soybeans. It is suited to small grain and to grasses or legumes for hay or pasture. If cultivated crops are grown, soil blowing is a hazard. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil is poorly suited to terracing because ridging the moderately coarse textured material is difficult and because the underlying coarse textured material is too close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. Droughtiness is a limitation in most years unless rainfall is timely. Yields are affected by the amount and timeliness of rainfall. The soil warms up quickly in the spring, thus stimulating early plant growth, particularly on south- and east-facing slopes. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration and the available water capacity.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, causes surface compaction, poor tilth, and excessive damage to the plants. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

285B—Burkhardt sandy loam, 2 to 5 percent slopes. This gently sloping, somewhat excessively drained soil is on alluvial terraces. Areas are irregularly shaped and are from 5 to 10 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 7 inches thick. The subsurface layer also is very dark grayish brown sandy loam. It is about 4 inches thick. The subsoil is about 9 inches thick. It is loose. The upper part is dark brown sandy loam, and the lower part is loamy sand in which the content of fine gravel is about 10 percent. The upper part of the substratum is dark yellowish brown gravelly coarse sand. The lower part to a depth of about 60 inches is strong brown sand and coarse sand in which the content of fine gravel is about 15 percent. In places the surface layer is gravelly sandy loam.

Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Runoff is medium. Available water capacity is low or very low. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is strongly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Many areas are cultivated. Some are used as permanent pasture. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay and pasture. It is very droughty and is subject to soil blowing and water erosion if it is cultivated. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss and conserves moisture. Returning crop residue or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration and the available water capacity.

A cover of pasture plants or hay is effective in controlling soil blowing and water erosion. Overgrazing, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and the soil in good condition.

A few areas are wooded. This soil is moderately suited to trees. It is droughty in most years. Seedlings do not survive well. As a result, they should be planted at close intervals. Thinning the stands helps to provide adequate growing space for the surviving trees.

The land capability classification is IVs.

302B—Coggon loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex ridgetops and side slopes in the uplands. Areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is black loam about 3 inches thick. The subsurface layer is dark grayish brown and brown loam about 10 inches thick. The subsoil is loam about 37 inches thick. The upper part is yellowish brown and friable; the next part is yellowish brown, mottled, and firm; and the lower part is mottled yellowish brown and grayish brown and is firm. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown loam. A stone line separates the surface sediments from the underlying firm glacial till.

Included with this soil in mapping are areas of the somewhat poorly drained Schley soils. These soils typically are near the head of upland drainageways. They make up about 5 to 10 percent of the unit.

Permeability is moderate in the Coggon soil, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction in the surface layer typically is slightly acid, but in some areas it varies widely as a result of local liming practices. The subsoil is strongly acid or very strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial till. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIe.

323B—Terril loam, sandy substratum, 2 to 5 percent slopes. This gently sloping, well drained soil is on foot slopes and in upland drainageways. Areas generally are long and narrow and range from 5 to 20 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is about 24 inches of black and very dark brown silt loam and loam. The subsoil is very dark grayish brown, friable sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown sand. In some places the surface soil is less than 24 inches thick. In other places the surface layer is sandy loam.

Permeability is moderate in the upper part of the profile and rapid in the substratum. Runoff is medium in cultivated areas. Available water capacity is high. The content of organic matter in the surface layer is about 4 to 5 percent. Reaction typically is slightly acid throughout the profile. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Because this soil generally occurs as long and narrow areas, it tends to be used for the same purposes as the adjacent soils. Many areas are cultivated along with the bottom land downslope. Some are used as permanent pasture along with the steeper soils upslope. The soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Because it receives runoff from the steeper soils upslope, however, it is subject to rill erosion and gullying. Diversion terraces help to control the runoff. Reshaping and seeding waterways help to prevent gullying.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

353B—Tell silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on alluvial terraces and on uplands. Areas are irregularly shaped and range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 4 inches thick. The subsoil is about 19 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam, the next part is yellowish brown silty clay loam, and the lower part is brown loam. The substratum to a depth of about 60 inches is yellowish brown loamy sand and sand. In places the soil is moderately sloping.

Permeability is moderate in the upper part of the profile and rapid in the substratum. Runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction in the surface layer varies widely as a result of local liming practices. The subsoil ranges from slightly acid to strongly acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. This soil is moderately suited to corn and soybeans. It is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. The soil is poorly suited to terracing because the coarse textured material is too close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some small areas support native hardwoods. This soil is well suited to trees. Plant competition is moderate. It can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIe.

377B—Dinsdale silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex ridges and side slopes in the uplands. Areas are irregularly shaped and range from 2 to more than 100 acres in size.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is about 29 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. A stone line separates the loess and the underlying firm glacial till.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid or medium acid. It generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial till. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

377C—Dinsdale silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex side slopes in the uplands. Areas are irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is about 29 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. A stone line separates the loess and the underlying firm glacial till.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid or medium acid. It generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn and soybeans. It is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a moderate or severe hazard. Terraces, a system of conservation tillage that leaves crop residue on the surface, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial till. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

377C2—Dinsdale silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on convex side slopes in the uplands. Areas are irregularly shaped and range from 2 to 15 acres in size.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. Plowing has mixed some streaks and pockets of brown silty clay loam subsoil material into the surface layer. The subsoil is about 25 inches thick. The upper part is brown, friable silty clay loam, and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. A stone line separates the loess and the underlying firm glacial till.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid or medium acid. It generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn and soybeans. It is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. Terraces and a system of conservation tillage that leaves crop residue on the surface help to prevent excessive soil loss. Grassed waterways help to prevent gully erosion. If terraces are built, cuts should not expose the less productive underlying glacial till. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen generally is needed on this soil than on Dinsdale soils that are less eroded. Also, more intensive management is needed to maintain productivity and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

391B—Clyde-Floyd complex, 1 to 4 percent slopes. These very gently sloping and gently sloping soils are in drainageways on glacial uplands. In most areas the poorly drained Clyde soil is in the lowest part of the drainageway and has a slope of less than 2 percent. The somewhat poorly drained Floyd soil occurs as bands bordering the Clyde soil and has a slope of 1 to 4 percent. Areas range from 10 to more than 200 acres in size. They are about 50 percent Clyde soil and 35 percent Floyd soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the Clyde soil has a surface layer of black clay loam about 9 inches thick. The subsurface layer is black clay loam about 14 inches thick. The subsoil is about 18 inches thick. The upper part is gray, mottled, friable loam; the next part is mottled gray and yellowish brown, friable loam that has a sandy stratum 1 inch thick; and the lower part is gray, mottled, firm loam. The substratum to a depth of about 60 inches is mottled gray and yellowish brown loam.

Typically, the Floyd soil has a surface layer of black loam about 9 inches thick. The subsurface layer is black and very dark brown loam about 13 inches thick. The subsoil is mottled loam about 35 inches thick. The upper part is dark grayish brown and friable, the next part is olive brown and light olive brown and is firm, and the lower part is grayish brown and firm. The substratum to a depth of about 60 inches is grayish brown, mottled loam.

Included with these soils in mapping are small areas of Schley soils and the very poorly drained Palms soils. Palms soils are in areas of hillside seeps. They have an organic matter content of more than 20 percent. Schley soils are more acid than the Clyde and Floyd soils and contain less organic matter. They are on concave side slopes. Palms and Schley soils make up about 10 percent of the unit. Also included are small areas where permeability is slower and the shrink-swell potential is slightly higher because clayey material is at a depth of 2 to 4 feet. These areas are in positions on the landscape similar to the Clyde and Floyd soils. They make up less than 5 percent of the unit.

Permeability is moderate in the Clyde and Floyd soils, and runoff is slow. Available water capacity is high. The soils have a seasonal high water table. The content of organic matter is about 7 to 9 percent in the surface layer of the Clyde soil and 5 to 7 percent in the surface layer of the Floyd soil. Reaction typically is neutral in the subsoil of the Floyd soil and slightly acid in the subsoil of the Clyde soil. The subsoil in both soils generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Inadequately drained areas generally are used for pasture. If artificially drained and protected against runoff from the higher elevations, these soils are well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Tiling these soils may leave rock fragments of cobble size on the surface. These cobbles are from the stone line at the boundary between the loamy sediments and the underlying glacial till. They can hinder tillage if left on the surface. Gullying is a hazard in areas of concentrated runoff. Grassed waterways help to prevent gully erosion. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Glacial stones and boulders are common in many unimproved, undrained areas. They should be removed before the soils are tile drained and cultivated. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soils or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If these soils are used for pasture, overgrazing or grazing when the soils are too wet causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soils in good condition.

The land capability classification is IIw.

399—Readlyn loam, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on broad divides or at the slightly concave head of drainageways in the uplands. Areas are irregularly shaped and range from 2 to several hundred acres in size.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown loam about 4 inches thick. The subsoil is mottled loam about 37 inches thick. The upper part is dark grayish brown and olive brown and is friable, and the lower part is yellowish brown and firm. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. In places the surface soil is thinner and has a lower content of organic matter.

Permeability is moderate, and runoff is slow or medium. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 5 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid or neutral. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. In some areas tile drainage is needed to reduce the wetness and improve the timeliness of fieldwork. Tiling this soil may leave rock fragments of cobble size on the surface. These cobbles are from the stone line at the boundary between the loamy sediments and the underlying glacial till. They can hinder tillage if left on the surface. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is I.

407B—Schley loam, 1 to 4 percent slopes. This gently sloping, somewhat poorly drained soil is on glaciated uplands. Areas are irregularly shaped and range from 3 to about 120 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is dark grayish brown loam about 11 inches thick. The subsoil is loam about 26 inches thick. The upper part is olive brown and yellowish brown, mottled, and friable, and the lower part is mottled strong brown and grayish brown and is firm. The substratum to a depth of about 60 inches is strong brown, mottled loam.

Included with this soil in mapping are small areas of soils that have a gravelly loamy sand or loamy sand surface layer. These soils are lower in organic matter content than the Schley soil and have a lower available water capacity. Also included are some areas of soils that are more slowly permeable than the Schley soil because they have clayey material at a depth of 2 to 4 feet. These soils tend to be excessively wet and seepy for extended periods at the base of side slopes. Included soils are in landscape positions similar to those of the Schley soil. They make up about 2 to 5 percent of the unit.

Permeability is moderate in the Schley soil, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid or neutral. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Inadequately drained areas are used for pasture or hay. This soil is well suited to corn, soybeans, and small grain and to grasses or legumes for hay or pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Tiling this soil may leave rock fragments of cobble size on the surface. These cobbles are from the stone line at the boundary between the loamy sediments and the underlying glacial till. They can hinder tillage if left on the surface. Gullying is a hazard in areas of concentrated runoff. Measures that help to control the runoff from the higher elevations are needed. Grassed waterways help to prevent gullying. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Glacial stones and boulders are common in many unimproved areas. They should be removed before the soil is tile drained and cultivated. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is only moderately suited to trees because it has a seasonal high water table and remains wet for long periods after rainfall. A drainage system is needed to reduce the seedling mortality rate. Equipment should be used only during the drier periods.

The land capability classification is IIw.

408B—Olin fine sandy loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex ridgetops and side slopes in the uplands. Areas are irregularly shaped and somewhat oval and range from 3 to 60 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown fine sandy loam about 14 inches thick. The subsoil is about 25 inches thick. The upper part is brown, very friable fine sandy loam, and the lower part is dark yellowish brown and yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. A stone line separates the surface sediments from the underlying firm glacial till. In places the soil is loam throughout.

Included with this soil in mapping are small areas of the somewhat poorly drained Floyd and Schley soils along upland drainageways and small areas of the excessively drained Sparta soils. Sparta soils are in positions on the landscape similar to those of the Olin soil. Floyd and Schley soils contain more clay and less sand in the upper part than the Olin soil and have a higher available water capacity. Included soils make up about 2 percent of the unit.

Permeability is moderately rapid in the upper part of the Olin soil and moderate in the lower part. Runoff is slow. Available water capacity is high. The content of organic matter in the surface layer is about 2 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is strongly acid or medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Many small areas are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to grasses or legumes for hay or pasture. If cultivated crops are grown, soil blowing is a hazard. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil is not well suited to terracing because ridging the moderately coarse textured material is difficult and because the less productive underlying glacial till is too close to the surface. If terraces are built, cuts should not expose the glacial till. Droughtiness is a limitation unless rainfall is timely. Yields are affected by the amount and timeliness of rainfall. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, causes surface compaction, poor tilth, and excessive damage to the plants. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

408C—Olin fine sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on short, convex side slopes in the uplands. Areas generally are long and narrow and range from 3 to 15 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 5 inches thick. The subsoil is about 26 inches thick. The upper part is brown, very friable fine sandy loam, and the lower part is dark yellowish brown and yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. A stone line separates the surface sediments from the underlying firm glacial till. In places the depth to glacial till is more than 40 inches.

Included with this soil in mapping are small areas of the excessively drained Sparta soils. These soils are in positions on the landscape similar to those of the Olin soil. They make up about 3 percent of the unit.

Permeability is moderately rapid in the upper part of the Olin soil and moderate in the lower part. Runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 1 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid or medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Many small areas are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to grasses or legumes for hay or pasture. If cultivated crops are grown, soil blowing is a hazard. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil is not well suited to terracing because ridging the moderately coarse textured material is difficult and because the less productive underlying glacial till is too close to the surface. If terraces are built, cuts should not expose the glacial till. Droughtiness is a limitation unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing and grazing when the soil is too wet or too dry, however, causes surface compaction, poor tilth, and excessive damage to the plants. Proper stocking rates pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

412C—Sogn loam, 2 to 9 percent slopes. This gently sloping and moderately sloping, shallow, somewhat excessively drained soil is on convex ridges and short side slopes in the uplands. Areas are irregularly shaped and somewhat elongated and range from 2 to 20 acres in size.

Typically, the surface layer is very dark brown loam about 10 inches thick. The subsurface layer is also very dark brown loam. It is about 6 inches thick. Fractured limestone bedrock is at a depth of about 16 inches. In places the surface layer is loamy sand or sand.

Included with this soil in mapping are small areas of exposed bedrock, which interferes with tillage. These areas are in positions on the landscape similar to those of the Sogn soil. They make up about 5 percent of the unit.

Permeability is moderate in the Sogn soil, and runoff is medium or rapid. Available water capacity is low or very low. The content of organic matter in the surface layer is about 2 to 3 percent. The root zone is limited by the limestone bedrock. The surface soil typically is neutral. It generally has a very low supply of available phosphorus and potassium.

Most areas are used for pasture. Some small areas are cropped along with larger areas of adjacent soils that are better suited for crops. This soil is unsuitable for cultivated crops because of the limited root zone. It is better suited to grasses and legumes for hay and pasture. Droughtiness is a severe limitation. A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is poorly suited to trees. Seedling mortality and the windthrow hazard are severe. Plant competition is moderate. It can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. Harvest methods that do not leave individual trees widely spaced reduce the windthrow hazard.

The land capability classification is VIIs.

426B—Aredale silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex ridges and side slopes in the uplands. Areas are irregularly shaped and range from 10 to 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer also is very dark grayish brown silt loam. It is about 4 inches thick. The subsoil is about 27 inches thick. It is friable.

The upper part is brown silt loam, the next part is dark yellowish brown loam, and the lower part is yellowish brown fine sandy loam. The upper 17 inches of the substratum is yellowish brown loamy fine sand. The lower part to a depth of about 60 inches is yellowish brown, mottled loam. In places the surface soil is sandy loam.

Permeability is moderate, and runoff is slow. Available water capacity is moderate. The content of organic matter in the surface layer is about 3 to 4 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. It is medium acid in the middle and lower parts of the subsoil and in the upper part of the substratum. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying loamy fine sand or glacial till. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

426C—Aredale silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex side slopes in the uplands. Areas are irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer also is very dark grayish brown silt loam. It is about 4 inches thick. The subsoil is about 27 inches thick. It is friable. The upper part is brown silt loam, the next part is dark yellowish brown loam, and the lower part is yellowish brown fine sandy loam. The upper 17 inches of the substratum is yellowish brown loamy fine sand. The lower part to a depth of about 60 inches is yellowish brown, mottled loam. In places the surface soil is sandy loam.

Permeability is moderate, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 3 to 4 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. It is medium acid in the middle and lower parts of the subsoil and in the upper part of the substratum. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn and soybeans. It is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a moderate or severe hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying loamy fine sand or glacial till. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

428B—Ely silty clay loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on concave foot slopes in the uplands. Areas are long and narrow or irregularly shaped and range from 5 to 20 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown silty clay loam about 18 inches thick. The subsoil is mottled, friable silty clay loam about 23 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is mottled grayish brown, light olive brown, and strong brown silty clay loam. In places the surface soil is very dark grayish brown silt loam less than 24 inches thick.

Permeability is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 6 percent. Reaction typically is medium acid or slightly acid throughout the profile, but in some areas it varies widely in the surface layer as a result of local liming practices. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Grassed waterways help to prevent gully erosion. If row crops are grown, a drainage system is needed to lower the water table and to improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, grazing should be restricted during wet periods. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

468B—Olin Variant sandy loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex ridgetops and side slopes in the uplands. Areas are irregularly shaped and somewhat oval and range from 3 to 20 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsurface layer is dark grayish brown sandy loam about 6 inches thick. The subsoil is about 30 inches thick. The upper part is brown, friable sandy loam, and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is strong brown, mottled loam. A stone line separates the surface sediments from the underlying firm glacial till.

Included with this soil in mapping are small areas of Chelsea soils. These soils are loamy sand or sand throughout and are lower in available water capacity than the Olin Variant soil. They are in landscape positions similar to those of the Olin Variant soil. They make up about 5 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Olin Variant soil and moderate in the lower part. Runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 1 percent. Reaction typically varies widely in the surface layer as the result of local liming practices. The subsoil is slightly acid or medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Many small areas are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, soil blowing is a hazard. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil is not well suited to terracing because ridging the moderately coarse textured material is difficult and because the less productive underlying glacial till is too close to the surface. If terraces are built, cuts should not expose the glacial till. Droughtiness is a limitation unless rainfall is timely. Yields are affected by the amount and timeliness of rainfall. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, causes surface compaction, poor tilth, and excessive damage to the plants. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

Some small areas support native hardwoods. This soil is well suited to trees. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIe.

468C—Olin Variant sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex ridgetops and side slopes in the uplands. Areas generally are long and narrow and range from 3 to 40 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsurface layer is dark grayish brown sandy loam about 6 inches thick. The subsoil is about 25 inches thick. The upper part is brown and yellowish brown, friable fine sandy loam, and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is strong brown, mottled loam. A stone line separates the surface sediments from the underlying firm glacial till. In places the depth to glacial till is more than 40 inches.

Permeability is moderately rapid in the upper part of the profile and moderate in the lower part. Runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is less than 0.5 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid or medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Many small areas are cropped along with larger areas of adjacent soils that are not so well suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, soil blowing is a hazard. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil is not well suited to terracing because ridging the moderately coarse textured material is difficult and because the less productive underlying glacial till is too close to the surface. If terraces are built, cuts should not expose the glacial till. Droughtiness is a limitation unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, causes surface compaction, poor tilth, and excessive damage to the plants. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

Some small areas support native hardwoods. This soil is well suited to trees. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

471—Oran loam, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on glacial uplands. Areas are irregularly shaped and range from 2 to 40 acres in size.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is dark grayish brown and dark brown loam about 9 inches thick. The subsoil is loam about 33 inches thick. The upper part is olive brown, mottled, and friable; the next part is mottled yellowish brown and grayish brown and is firm; and the lower part is yellowish brown, mottled, and firm. The substratum to a depth of about 60 inches is strong brown, mottled loam. In places the surface layer is loamy sand.

Included with this soil in mapping are small areas of poorly drained soils in depressions. These soils make up about 2 percent of the unit.

Permeability is moderate in the Oran soil, and runoff is slow or medium. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is dominantly medium acid or strongly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. In some areas tile drainage is needed to reduce the wetness and improve the timeliness of fieldwork. Tiling this soil may leave rocks and pebbles on the surface. These rocks and pebbles are from the stone line at the boundary between the loamy sediments and the underlying glacial till. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay improves soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is only moderately suited to trees because it has a seasonal high water table and remains wet for long periods after rainfall. A drainage system is needed to reduce the seedling mortality rate.

The land capability classification is I.

478G—Nordness-Rock outcrop complex, 25 to 60 percent slopes. This very steep map unit occurs as areas of Rock outcrop intermingled with areas of a shallow, well drained Nordness soil. It is on escarpments and upland slopes along the major streams. The escarpments commonly are 100 to 200 feet high. The precipitous slopes commonly are wooded and covered by huge masses and blocks of limestone broken off from the higher lying adjacent slopes. Areas are about 45 percent Nordness soil and 40 percent Rock outcrop. The Nordness soil and the Rock outcrop occur as areas so intricately mixed that mapping them separately is impractical.

Typically, the Nordness soil has a surface layer of very dark gray silt loam about 1 inch thick. The subsurface layer is dark grayish brown silt loam about 2 inches thick. The subsoil is about 5 inches thick. The upper part is brown, friable silt loam, and the lower part is dark brown, very firm silty clay. Fractured limestone is at a depth of about 8 inches. Limestone fragments are common on the surface and throughout the soil.

Typically, the Rock outcrop is limestone bedrock. A thin layer of silt loam or loam covers the bedrock in some areas.

Included with this unit in mapping are areas of the moderately deep Dubuque soils on the upper parts of the slopes. These soils make up about 10 percent of the unit. Also included are areas of Nordness soils that have a slope of more than 60 percent. These soils make up about 5 percent of the unit.

Permeability is moderate in the Nordness soil, and runoff is very rapid. Available water capacity is very low. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically is neutral or slightly acid throughout the profile. The subsoil generally has a very low supply of available phosphorus and potassium. Tilth is poor.

Most areas are wooded (fig. 10). A few are used as permanent pasture. This map unit is unsuitable for cultivated crops and for hay and pasture because of the very steep slope and the Rock outcrop.

This map unit is poorly suited to trees. Seedling mortality is severe on the Nordness soil because of the very steep slope and the shallowness to limestone bedrock. The limestone is fractured, however, and tree roots can penetrate the rock crevasses. Ordinary equipment cannot be used because of the very steep slopes. Special equipment can be used, but caution is needed in operating this equipment. Harvest methods that do not leave individual trees widely spaced reduce the windthrow hazard.

Careful development of logging roads is needed because of the very steep slope and the susceptibility to erosion.

The land capability classification is VIIs.

485—Spillville loam, 0 to 2 percent slopes. This nearly level, moderately well drained or somewhat poorly drained soil is on flood plains and along intermittent streams. It is subject to flooding. Areas are somewhat long and narrow and range from 4 to about 35 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is black and very dark gray loam about 34 inches thick. The upper part of the substratum is brown, mottled loam. The lower part to a depth of about 60 inches is mottled yellowish brown and

Figure 10.—Native hardwoods in an area of Nordness-Rock outcrop complex, 25 to 60 percent slopes.

light brownish gray sandy loam. In places the surface layer is sandy loam.

Permeability is moderate, and runoff is slow. Available water capacity is high or very high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 5 percent. Reaction typically is neutral to medium acid throughout the profile. The soil generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled.

Most areas are cultivated. Some are used for pasture or hay. If protected from floodwater, this soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses or legumes for hay or pasture. Diversion terraces are needed in some areas to control the floodwater. The need for flood protection varies from area to area because the flooding pattern was modified when stream channels were deepened and straightened. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

488C2—Newvienna silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on convex side slopes and nose slopes in the uplands. Areas are irregularly shaped and range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. Plowing has mixed some streaks and pockets of yellowish brown silt loam subsoil material into the surface layer. The subsoil is about 27 inches thick. It is yellowish brown and friable. The upper part is silt loam, and the lower part is mottled silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the subsoil has no mottles.

Permeability is moderate, and runoff is medium. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically is neutral in the surface layer and slightly acid or medium acid in the subsoil. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. Subsurface tile drains generally are needed to improve the timeliness of fieldwork.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree cuttings and seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIIe.

488D2—Newvienna silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex side slopes and nose slopes in the uplands. Areas are irregularly shaped and range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. Plowing has mixed some streaks and pockets of yellowish brown silt loam subsoil material into the surface layer. The subsoil is about 25 inches thick. It is yellowish brown and friable. The upper part is silt loam, and the lower part is mottled silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the subsoil has no mottles.

Permeability is moderate, and runoff is rapid. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically is neutral in the surface layer and slightly acid or medium acid in the subsoil. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet. The puddling and crusting increase the runoff rate and retard plant growth.

Most areas are cultivated. This soil is suited to corn and soybeans occasionally grown in rotation with small grain. It also is suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Subsurface tile drains generally are needed to improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree cuttings and seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIIe.

489—Ossian silt loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on bottom land, low alluvial terraces, and the lower parts of broad upland drainageways. It is subject to flooding. Areas are irregularly shaped and range from 5 to 80 acres in size.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer also is black silt loam about 8 inches thick. The subsoil is mottled, friable silt loam about 26 inches thick. The upper part is very dark gray, the next part is dark gray, and the lower part is olive gray. The substratum to a depth of about 60 inches is gray and light olive gray, mottled silt loam. In some places the surface layer and subsurface layer are silty clay loam. In other places the surface layer is dark grayish brown silt loam.

Permeability is moderate, and runoff is very slow. Available water capacity is very high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 7 percent. Reaction typically is neutral throughout the profile. The subsoil generally has a low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. A few are used for pasture. If drained and protected from floodwater, this soil is well suited to corn, soybeans, and small grain. It is wet as a result of the occasional flooding, the slow runoff, and the seasonal high water table. Plowing is difficult, and tillage is delayed in some years because of excessive wetness. Tile drains function well if suitable outlets are available. Diversion terraces on the adjoining uplands help to control runoff from the uplands.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, increases the likelihood of puddling. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

499B—Nordness silt loam, 2 to 5 percent slopes. This gently sloping, shallow, well drained soil is on convex ridges and short side slopes in the uplands. Areas are irregularly shaped and range from 2 to 25 acres in size.

Typically, the surface layer is very dark gray silt loam about 5 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 10 inches thick. It is brown. The upper part is friable silt loam, and the lower part is firm silty clay. Fractured limestone bedrock is at a depth of about 18 inches.

Permeability is moderate, and runoff is medium. Available water capacity is very low. The content of organic matter in the surface layer is about 2 percent. The shrink-swell potential is high in the subsoil. The root zone is limited by the limestone bedrock. The upper part of the subsoil typically is medium acid. The subsoil generally has a very low supply of available phosphorus and potassium. The soil tends to crust after hard rains and puddle if tilled when wet.

Some areas are cultivated. This soil is poorly suited to corn, soybeans, and small grain. It is better suited to grasses and legumes for hay and pasture. Droughtiness is a severe limitation. Also, erosion is a hazard if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Tillage is difficult because the soil is shallow to bedrock and limestone slabs are at the surface. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is poorly suited to trees. Seedling mortality is severe because of the shallowness to limestone bedrock. Harvest methods that do not leave individual trees widely spaced reduce the windthrow hazard.

The land capability classification is IVs.

499D—Nordness silt loam, 5 to 14 percent slopes. This moderately sloping and strongly sloping, shallow, well drained soil is on short side slopes in the uplands. Areas are long and narrow and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 10 inches thick. It is brown. The upper part is friable silt loam, and the lower part is firm silty clay. Fractured limestone bedrock is at a depth of about 18 inches.

Permeability is moderate, and runoff is medium or rapid. Available water capacity is very low. The content of organic matter in the surface layer is about 1 to 2 percent. The shrink-swell potential is high in the subsoil. The root zone is limited by the limestone bedrock. The subsoil typically is medium acid. It generally has a very low supply of available phosphorus and potassium. The soil tends to crust after hard rains and puddle if tilled when wet.

Some areas are cultivated. This soil is generally unsuited to cultivated crops. It is moderately suited to grasses and legumes for hay or pasture. Droughtiness is a severe limitation. A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is poorly suited to trees. Seedling mortality is severe because of the shallowness to limestone bedrock. Harvest methods that do not leave individual trees widely spaced reduce the windthrow hazard.

The land capability classification is VIs.

499F—Nordness silt loam, 14 to 25 percent slopes. This moderately steep and steep, shallow, well drained soil is on short side slopes on uplands and escarpments. Areas are long and narrow and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 10 inches thick. It is brown. The upper part is friable silt loam, and the lower part is firm silty clay. Fractured limestone bedrock is at a depth of about 18 inches.

Included with this soil in mapping are some outcrops of limestone bedrock. These outcrops are in positions on the landscape similar to those of the Nordness soil. They make up about 10 percent of the unit.

Permeability is moderate in the Nordness soil, and runoff is rapid. Available water capacity is very low. The content of organic matter in the surface layer is about 1 percent. The shrink-swell potential is high in the subsoil. The root zone is limited by the limestone bedrock. The upper part of the subsoil typically is medium acid. The subsoil generally has a very low supply of available phosphorus and potassium. The soil tends to crust after hard rains and puddle if tilled when wet.

Most areas are used as woodland or wildlife habitat. Some small areas are used as permanent pasture. This soil is generally unsuitable for cultivated crops because of the slope and a severe erosion hazard. It is extremely limited as a site for grasses and legumes for hay and pasture. Renovating pasture is difficult because of the shallowness to bedrock. Ordinary farm machinery cannot be used because limestone slabs are at the surface and the slope generally is too steep. The number of livestock that can graze the pasture without damaging the plant cover is low. As a result, controlled grazing is needed.

Most areas support native hardwoods. This soil is poorly suited to trees. Seedling mortality is severe because of the shallowness to limestone bedrock. The hazards or limitations that affect planting or harvesting are moderate. Harvest methods that do not leave individual trees widely spaced reduce the windthrow hazard. The hazard of erosion and the equipment limitation are moderate. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment and caution in operating the equipment are needed.

The land capability classification is VIIs.

585—Spillville-Coland complex, 0 to 2 percent slopes. These nearly level, moderately well drained to poorly drained soils are on alluvial flood plains along the major streams and some of their tributaries. The soils are subject to flooding. Areas are irregularly shaped and range from 2 to more than 100 acres in size. They are about 50 percent Spillville soil and 40 percent Coland soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the Spillville soil has a surface layer of black loam about 7 inches thick. The subsurface layer is black and very dark gray loam about 34 inches thick. The upper part of the substratum is brown, mottled loam. The lower part to a depth of about 60 inches is mottled yellowish brown and light brownish gray sandy loam.

Typically, the Coland soil has a surface layer of black clay loam about 7 inches thick. The subsurface layer is black, mottled clay loam about 31 inches thick. The upper part of the substratum is gray and very dark gray, mottled clay loam. The lower part to a depth of about 60 inches is gray gravelly sandy loam. In places the substratum is sand and gravel.

Included with these soils in mapping are small areas of the poorly drained Marshan soils in depressions. These included soils have a clay loam surface layer and are underlain by sand and gravel within a depth of 40 inches. They make up about 10 percent of the unit.

Permeability is moderate in the Spillville and Coland soils, and runoff is slow. Available water capacity is high. The soils have a seasonal high water table. The content of organic matter in the surface layer is about 4 to 7 percent. The shrink-swell potential is high in the Coland soil. Both soils typically are neutral or slightly acid throughout. Their subsurface layer generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for pasture. Some are cultivated. The Coland soil is moderately suited to corn, soybeans, and small grain. The Spillville soil is well suited to intensive cropping of corn, soybeans, and small grain. Yields vary because of the difficulty in draining wet areas and in providing flood protection. Installing a tile drainage system and establishing levees in some areas increase productivity.

These soils are suited to grasses and legumes for pasture. Overgrazing or grazing when the soils are too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soils in good condition.

The land capability classification is IIw.

663D2—Seaton silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex, narrow ridgetops and side slopes in the uplands. Areas generally are long and narrow or irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. Plowing has mixed some streaks and pockets of yellowish brown silt loam subsoil material into the surface layer. The subsoil is yellowish brown, friable silt loam about 46 inches thick. The substratum to a depth of about 60 inches is yellowish brown silt loam. In places stratified loam and sandy loam are in the subsoil and substratum.

Permeability is moderate, and runoff is medium. Available water capacity is very high. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid to strongly acid. It generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and contour farming help to prevent excessive soil loss. Establishing terraces on this soil is difficult because the subsoil is very erodible. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some small areas support native hardwoods. This soil is well suited to trees. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

663E2—Seaton silt loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is on convex side slopes in the uplands. Areas are elongated and range from 10 to 40 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. Plowing has mixed some streaks and pockets of yellowish brown silt loam subsoil material into the surface layer. The subsoil is yellowish brown, friable silt loam about 46 inches thick. The substratum to a depth of about 60 inches is yellowish brown silt loam. In some small areas the surface layer is yellowish brown or brown. In places it is loamy sand.

Permeability is moderate, and runoff is medium or rapid. Available water capacity is very high. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid to strongly acid. It generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is poorly suited to corn, soybeans, and small grain. It is moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and contour farming help to prevent excessive soil loss. Establishing terraces on this soil is difficult because the subsoil is very erodible. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Special equipment may be needed because of the slope. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. Erosion is a moderate hazard. It can be controlled by carefully selecting sites for logging trails or roads and by laying out the trails or roads on the contour or nearly on the contour.

The land capability classification is IVe.

663E3—Seaton silt loam, 14 to 18 percent slopes, severely eroded. This moderately steep, well drained soil is on convex side slopes in the uplands. Areas are elongated and range from 5 to 40 acres in size.

Typically, the surface layer is yellowish brown silt loam about 6 inches thick. Streaks and pockets of grayish brown silt loam surface soil material make up about 10 to 15 percent of the surface layer. The subsoil is yellowish brown silt loam about 38 inches thick. The substratum to a depth of about 60 inches is yellowish brown silt loam. In places the surface layer is loamy sand.

Permeability is moderate, and runoff is medium or rapid. Available water capacity is very high. The content of organic matter in the surface layer is less than 0.5 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid to strongly acid. It generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is generally unsuitable for cultivated crops because of the slope and a severe erosion hazard. It is moderately suited to grasses and legumes for hay and pasture. A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is well suited to trees. Special equipment may be needed because of the slope. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. Erosion is a moderate hazard. It can be controlled by carefully selecting sites for logging trails or roads and by laying out the trails or roads on the contour or nearly on the contour.

The land capability classification is VIe.

725—Hayfield loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on alluvial terraces. Areas are irregularly shaped and range from 5 to 75 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 4 inches thick. The subsoil is about 19 inches thick. It is mottled and friable. The upper part is brown loam, and the lower part is grayish brown clay loam. The substratum to a depth of about 60 inches is light brownish gray, mottled loamy sand and gravel.

Permeability is moderate in the subsoil and rapid in the substratum. Runoff is slow. Available water capacity is low. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction typically varies in the surface layer as a result of local liming practices. The subsoil is medium acid or strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses or legumes for hay or pasture. Droughtiness is a limitation during periods of below normal rainfall. The water table is moderately high in the spring but drops rapidly during the growing season. In some areas tile drainage is beneficial during wet periods, but installing the tile is difficult because of the loose, water-bearing sand and gravel. If cultivated areas are plowed in the fall, soil blowing is a hazard unless the surface is protected. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay improves soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few small areas support native hardwoods. This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIs.

763E2—Exette silt loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is in coves along upland drainageways and on short, convex side slopes. Areas are elongated and range from 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. Plowing has mixed some streaks and pockets of yellowish brown silt loam subsoil material into the surface layer. The subsoil is friable silt loam about 24 inches thick. The upper part is yellowish brown and mottled, and the lower part is mottled grayish brown and yellowish brown. The substratum to a depth of about 60 inches is mottled light brownish gray and strong brown silt loam. In some areas the surface layer is yellowish brown.

Permeability is moderate, and runoff is rapid. Available water capacity is very high. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. Reaction typically is neutral or slightly acid in the surface layer and medium acid in the subsoil. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or woodland. This soil is poorly suited to corn, soybeans, and small grain. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. The soil generally is not suitable for terracing because the slopes are too steep and are short and complex. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in fairly good condition.

This soil is moderately well suited to trees. Seedlings survive and grow well, but the hazard of erosion and the equipment limitation are moderate. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment and caution in operating the equipment are needed.

The land capability classification is IVe.

763F2—Exette silt loam, 18 to 25 percent slopes, moderately eroded. This steep, well drained soil is in coves along upland drainageways and on short, convex side slopes that are dissected by many small waterways. Areas are elongated and are 5 to 10 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. Plowing has mixed some streaks and pockets of yellowish brown silt loam subsoil material into the surface layer. The subsoil is friable silt loam about 24 inches thick. The upper part is yellowish brown and mottled, and the lower part is mottled grayish brown and yellowish brown. The substratum to a depth of about 60 inches is mottled light brownish gray and strong brown silt loam. In some areas the surface layer is yellowish brown.

Permeability is moderate, and runoff is very rapid in cultivated areas. Available water capacity is very high. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. Reaction typically is neutral or slightly acid in the surface layer and medium acid in the subsoil. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. Tilth is poor. The soil tends to be cloddy after it has been worked when wet and tends to puddle during periods of heavy rainfall. The cloddiness and puddling increase the runoff rate and retard plant growth.

Many areas are cultivated. Some are used for pasture. This soil generally is unsuitable for cultivated crops because of the steep slope and a severe erosion hazard. It is only moderately well suited to hay. Operating farm machinery is difficult because of the steep slope and the many small waterways. Cultivated crops should be grown only to reestablish hay and pasture.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in fairly good condition.

This soil is moderately well suited to trees. Seedlings survive and grow well, but the hazard of erosion and the equipment limitation are moderate. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment and caution in operating the equipment are needed.

The land capability classification is VIe.

771B—Waubeek silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex ridges and side slopes in the uplands. Areas are irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 31 inches thick. The upper part is brown, friable silty clay loam; the next part is dark yellowish brown, friable silty clay loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. A stone line separates the loess and the underlying firm glacial till.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial till. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some small areas support native hardwoods. This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIe.

771C—Waubeek silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on short, convex side slopes in the uplands. Areas are irregularly shaped and range from 2 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 31 inches thick. The upper part is brown, friable silty clay loam; the next part is dark yellowish brown, friable silty clay loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. A stone line separates the loess and the underlying firm glacial till.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn and soybeans. It is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a moderate or severe hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and terraces help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial till. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some small areas support native hardwoods. This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

776—Lilah sandy loam, 0 to 2 percent slopes. This nearly level, excessively drained soil is on alluvial terraces. Areas are irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 7 inches thick. The subsurface layer is brown sandy loam about 5 inches thick. The subsoil is about 27 inches thick. It is very friable. The upper part is dark yellowish brown sandy loam, the next part is strong brown sandy loam in which the content of gravel is about 5 percent, and the lower part is brown gravelly loamy sand. The substratum to a depth of about 60 inches is strong brown sand.

Permeability is very rapid, and runoff is slow. Available water capacity is very low. The content of organic matter in the surface layer is about 0.5 to 1.0 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid in the upper part. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. Many small areas are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses or legumes for hay or pasture. Droughtiness is a severe limitation in most years unless rainfall is timely. Also, soil blowing is a hazard during most years. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss and conserve moisture. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration and the available water capacity.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet or too dry reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

A few small areas support native hardwoods. This soil is moderately suited to trees. Seedling mortality is severe because the soil is droughty. Supplemental water is needed in some areas. The hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IVs.

776C—Lilah sandy loam, 2 to 9 percent slopes. This gently sloping and moderately sloping, excessively drained soil is on alluvial terraces and on uplands (fig. 11). Areas generally are long and narrow and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 7 inches thick. The subsoil is about 15 inches thick. The upper part is brown, very friable sandy loam, and the lower part is strong brown, loose gravelly loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown and light yellowish brown sand. In places the surface layer is loamy sand.

Permeability is very rapid, and runoff is slow. Available water capacity is very low. The content of organic matter in the surface layer is less than 0.5 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid in the

Figure 11.—An area of Lilah sandy loam, 2 to 9 percent slopes, along Lake Delhi.

upper part. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Some areas are cultivated. Some small areas are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is poorly suited to corn and soybeans. It is suited to small grain and to grasses or legumes for hay or pasture. Droughtiness is a severe limitation in most years unless rainfall is timely. Also, soil blowing is a hazard if cultivated crops are grown. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration and the available water capacity.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

A few small areas support native hardwoods. This soil is moderately suited to trees. Seedling mortality is severe because the soil is droughty. Supplemental water is needed in some areas. The hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IVs.

777—Wapsie loam, 0 to 2 percent slopes. This nearly level, well drained soil is on alluvial terraces. Areas are irregularly shaped and range from 5 to more than 80 acres in size.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsurface layer is dark grayish brown loam about 4 inches thick. The subsoil is about 18 inches thick. It is brown and friable. It is loam in the upper part and gravelly sandy clay loam in the lower part. The substratum to a depth of about 60 inches is brown gravelly loamy sand.

Included with this soil in mapping are small, slightly depressional areas of poorly drained soils that remain wet for long periods. The wetness delays tillage unless a drainage system is installed. These included soils make up about 3 percent of the unit.

Permeability is moderate in the upper part of the Wapsie soil and very rapid in the substratum. Runoff is slow. Available water capacity is low or moderate. The content of organic matter in the surface layer is about 1 to 2 percent. The underlying sand and gravel somewhat limit the depth to which the roots of some crops can penetrate. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid or medium acid. It generally has a low or very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. This soil is moderately suited to corn, soybeans, and small grain and to grasses or legumes for hay or pasture. Droughtiness is a limitation in most years unless rainfall is timely. Also, soil blowing is a hazard in areas that are fall plowed and are not protected. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas support native hardwoods. This soil is moderately suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIs.

781B—Lourdes loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on slightly convex side slopes in the uplands. Areas are irregularly shaped and range from 2 to 40 acres in size.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 32 inches thick. The upper part is dark yellowish brown, friable loam, and the lower part is yellowish brown, mottled, very firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Floyd soils along upland drainageways. These soils make up less than 5 percent of the unit.

Permeability is moderate in the upper part of the subsoil in the Lourdes soil and moderately slow in the lower part and in the substratum. Runoff is medium. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil ranges from strongly acid to slightly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial till. Tiling this soil may leave rock fragments of cobble size on the surface. These cobbles are from the stone line at the boundary between the loamy sediments and the underlying glacial till. They can hinder tillage if left on the surface. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees, but no areas remain in native hardwoods. No problems affect the establishment of new stands if the proper species are selected for planting and the stands are managed properly.

The land capability classification is IIe.

782B—Donnan loam, 2 to 6 percent slopes. This gently sloping and moderately sloping, moderately well drained and somewhat poorly drained soil is on convex ridges and side slopes in the uplands. Areas are irregularly shaped and range from 2 to 80 acres in size.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsurface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown, friable loam; the next part is mottled strong brown and grayish brown, friable sandy loam; and the lower part is gray, very firm clay.

Permeability is moderate in the upper part of the profile and very slow in the lower part. Runoff is medium. Available water capacity is moderate or high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 2 to 3 percent. The shrink-swell potential is moderate or high in the lower part of the soil. The clayey part of the subsoil somewhat limits the depth to which the roots of some crops can penetrate. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid or strongly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Many small areas are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to legumes for hay. It is better suited to grasses and legumes for pasture. If cultivated crops are grown, erosion is a hazard unless the surface is protected by a plant cover. Also, wetness is a limitation. Measures that control erosion tend to increase the wetness because they retard the movement of surface water. As a result, a combination of terraces and tile drainage is needed. If terraces are built, cuts should not expose the less productive clayey part of the subsoil. In areas where a perched water table and seepage on side slopes are the major problems, a tile drainage system that is designed to intercept water is most likely to be successful. Because of the very slow permeability in the clayey part of the subsoil, installing tile is difficult and all areas cannot be drained satisfactorily. If possible, tile drains should be installed above the clayey part of the subsoil. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent surface crusting.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few small areas support native hardwoods. This soil is moderately suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight. The hazard of erosion also is slight.

The land capability classification is IIe.

793—Bertrand silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on alluvial terraces along the major streams and rivers. Areas are irregularly shaped and range from 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is brown silt loam about 6 inches thick. The subsoil is about 34 inches of yellowish brown, friable silt loam and silty clay loam. The substratum to a depth of about 60 inches is yellowish brown silt loam. In places the lower part of the subsoil is gravelly sand.

Permeability is moderate in the upper part of the profile and rapid in the substratum. Runoff is slow in cultivated areas. Available water capacity is high or very high. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction may vary widely in the surface layer as a result of local liming practices. The subsoil typically is medium acid or strongly acid in the upper part. It generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet. The puddling and crusting retard plant growth.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, the hazard of erosion is only slight. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Because it is below areas of more sloping upland soils, the soil is subject to siltation. Diversion terraces are needed in some areas to control local runoff. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the likelihood of puddling. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

A few areas are wooded. This soil is well suited to trees. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is I.

798B—Protivin loam, 1 to 4 percent slopes. This very gently sloping and gently sloping, somewhat poorly drained soil is on uplands. Areas generally are crescent shaped and range from 3 to 25 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer also is black loam about 7 inches thick. The subsoil is about 30 inches thick. The upper part is dark grayish brown, mottled, firm loam; the next part is olive brown, mottled, firm clay loam; and the lower part is mottled grayish brown and yellowish brown, very firm clay loam. The substratum to a depth of about 60 inches is mottled yellowish brown and light brownish gray clay loam. A stone line separates the loamy surficial sediments and the underlying very firm glacial till.

Included with this soil in mapping are some small areas of the extremely firm Donnan soils on convex ridges and side slopes. These very slowly permeable soils tend to be seepy at the base of the slopes. They make up about 4 percent of the unit.

Permeability is moderate in the upper part of the Protivin soil and moderately slow in the lower part. Runoff is medium. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is slightly acid or medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Inadequately drained areas generally are used for pasture. This soil is moderately suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. A combination of terraces and drainage tile is needed in some areas both to control erosion and to reduce the wetness. Tiling this soil may leave rock fragments of cobble size on the surface. These cobbles are from the stone line at the boundary between the loamy sediments and the underlying glacial till. They can hinder tillage if left on the surface. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

809B—Bertram fine sandy loam, 2 to 5 percent slopes. This gently sloping, moderately deep, somewhat excessively drained soil is on ridges and side slopes in the uplands. Areas are irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 13 inches thick. The subsoil is about 14 inches thick. The upper part is dark brown, very friable fine sandy loam, and the lower part is dark yellowish brown, friable sandy clay loam. Fractured limestone bedrock is at a depth of about 34 inches. Some tongues of strong brown, partially weathered limestone are between the limestone fragments.

Permeability is moderately rapid, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 1 to 2 percent. The root zone extends only to the limestone bedrock. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses or legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. Yields are affected by the amount and timeliness of rainfall. If cultivated crops are grown, water erosion and soil blowing are hazards. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling water erosion and soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

The land capability classification is IVs.

809C—Bertram fine sandy loam, 5 to 9 percent slopes. This moderately sloping, moderately deep, somewhat excessively drained soil is on ridges and side slopes in the uplands. Areas are irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 10 inches thick. The subsoil is about 12 inches thick. The upper part is dark brown, very friable fine sandy loam, and the lower part is dark yellowish brown, friable sandy clay loam. Fractured limestone bedrock is at a depth of about 29 inches. Some tongues of strong brown, partially weathered limestone are between the limestone fragments.

Permeability is moderately rapid, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 1 percent. The root zone extends only to the limestone bedrock. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Some of the larger areas are used for pasture or hay. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. Yields are affected by the amount and timeliness of rainfall. If cultivated crops are grown, water erosion and soil blowing are moderate or severe hazards. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling water erosion and soil blowing. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

The land capability classification is IVs.

826—Rowley silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on low alluvial terraces along small rivers and streams. It is subject to flooding. Areas are irregularly shaped and range from 10 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is very dark brown silt loam about 8 inches thick. The subsoil is friable silt loam about 45 inches thick. The upper part is dark grayish brown, the next part is grayish brown and mottled, and the lower part is mottled grayish brown and yellowish brown and is stratified with thin layers of sandy loam. In some places the upper part of the subsoil is dark gray. In other places about 16 inches of lighter colored overwash is on the surface.

Permeability is moderate, and runoff is slow. Available water capacity is high or very high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 3 or 4 percent. Reaction typically is neutral or medium acid in the surface soil and strongly acid in the subsoil. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is slightly wet, however, and receives runoff from the soils upslope. Establishing diversion terraces on those soils helps to protect this soil from overflow and siltation. Tile drainage improves the timeliness of fieldwork. If row crops are grown year after year, erosion is a slight hazard. A system of conservation tillage that leaves crop residue on the surface, however, helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent surface crusting.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the likelihood of puddling. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Equipment should be used only during the drier periods.

The land capability classification is IIw.

883B—Cresken clay loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on long, convex ridgetops and side slopes in the uplands. Areas are irregularly shaped or elliptical and range from 20 to more than 100 acres in size.

Typically, the surface layer is black clay loam about 7 inches thick. The subsurface layer is very dark brown and dark brown clay loam about 9 inches thick. The subsoil is clay loam about 29 inches thick. The upper part is brown and friable, the next part is yellowish brown and firm, and the lower part is mottled strong brown and grayish brown and is very firm. The substratum to a depth of about 60 inches is mottled strong brown, gray, and yellowish brown loam. In places the subsoil contains less clay.

Permeability is moderate in the upper part of the profile and moderately slow in the lower part. Runoff is medium. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 3 to 4 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial till. Tiling this soil may leave rock fragments of cobble size on the surface. These cobbles are from the stone line at the boundary between the loamy sediments and the underlying glacial till. They can hinder tillage if left on the surface. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

907B—Schley loam, sandy substratum, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on glaciated uplands. Areas are long and narrow or irregularly shaped and range from 10 to 50 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 4 inches thick. The subsoil is about 25 inches thick. The upper part is dark grayish brown, mottled, friable loam; the next part is grayish brown, mottled, friable loam; and the lower part is grayish brown, mottled sandy loam. The upper part of the substratum is mottled light brownish gray and dark grayish brown, friable sandy loam. The lower part to a depth of about 60 inches is yellowish brown loamy sand. In places the surface layer is sandy loam.

Permeability is moderate in the subsoil and rapid in the substratum. Runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction typically varies widely in the surface layer as a result of local liming practices. The subsoil is medium acid or strongly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable and can be easily tilled throughout a wide range of moisture content, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. Inadequately drained areas generally are used for pasture. This soil is well suited to corn, soybeans, and small grain and to grasses or legumes for hay or pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Also, soil blowing is a hazard in cultivated areas. Windblown sand grains sometimes damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. Gully erosion is a hazard in areas of concentrated runoff. A combination of terraces and drainage tile is needed in some areas both to control erosion and to reduce the wetness. The soil is not well suited to terracing, however, because ridging the moderately coarse textured material is difficult and because the underlying coarse textured material is too close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. A system of conservation tillage that leaves crop residue on the surface and winter cover crops help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas support native hardwoods. This soil is only moderately suited to trees because it has a seasonal high water table. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIw.

933B—Sawmill silty clay loam, 1 to 4 percent slopes. This very gently and gently sloping, poorly drained soil is in upland drainageways. It is subject to flooding. Areas are irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray silty clay loam about 20 inches thick. The subsoil is mottled, friable silty clay loam about 13 inches thick. The upper part is dark gray, and the lower part is olive gray. The substratum to a depth of about 60 inches is olive gray, mottled silty clay loam. In some small areas about 10 inches of very dark grayish brown silt loam overwash is on the surface. In places the surface soil is thinner.

Permeability is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 7 percent. Reaction typically is neutral in the surface layer and slightly acid in the subsoil, but it varies widely in the surface layer as a result of local liming practices. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and puddles if tilled when wet.

Most areas are cultivated. Inadequately drained areas generally are used for pasture. If artificially drained and protected against runoff from the higher elevations, this soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

977—Richwood silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on alluvial terraces along the major streams and rivers. Areas are irregularly shaped and range from 5 to 25 acres in size.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 14 inches thick. The subsoil is friable silt loam about 25 inches thick. The upper part is brown and dark yellowish brown, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is yellowish brown silt loam.

Permeability is moderate, and runoff is slow. Available water capacity is high or very high. The content of organic matter in the surface layer is about 2 to 5 percent. Reaction typically is neutral or slightly acid in the surface soil. The subsoil is medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It occasionally receives local runoff from the soils upslope. Establishing diversion terraces on those soils, however, helps to protect this soil from overflow and siltation. Erosion is a slight hazard if row crops are grown year after year. It can be controlled, however, by a system of conservation tillage that leaves crop residue on the surface. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the likelihood of puddling. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is I.

981—Worthen silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on low lying terraces. Areas are irregularly shaped and range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown and very dark brown silt loam about 31 inches thick. The subsoil is friable silt loam about 21 inches thick. The upper part is dark brown, and the lower part is dark yellowish brown.

Permeability is moderate, and runoff is slow. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 5 percent. Reaction typically is neutral or medium acid in the surface layer and strongly acid or medium acid in the subsoil. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. It receives local runoff from the soils upslope. Establishing diversion terraces on those soils, however, helps to protect this soil from overflow and siltation. Erosion is a slight hazard if row crops are grown year after year. It can be controlled, however, by a system of conservation tillage that leaves crop residue on the surface. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the likelihood of puddling. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is I.

981B—Worthen silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on alluvial fans and foot slopes at the base of loess-covered uplands and on the upper parts of narrow, U-shaped drainageways in the uplands. Areas are elongated and range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 31 inches thick. The subsoil is friable silt loam about 21 inches thick. The upper part is dark brown, and the lower part is dark yellowish brown. In places the soil is moderately sloping.

Permeability is moderate, and runoff is medium in cultivated areas. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 5 percent. Reaction typically is neutral or medium acid in the surface layer and strongly acid or medium acid in the subsoil. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It receives runoff from the more sloping soils upslope, however, and erosion is a slight hazard if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

1485—Spillville loam, channeled, 0 to 2 percent slopes. This nearly level, moderately well drained or somewhat poorly drained soil is on flood plains along the larger streams and their tributaries. It is frequently flooded. The landscape is generally cut by many stream channels. As a result, escarpments are common on the higher alluvial terraces. Oxbows and marshy areas are below most of the escarpments. Areas are long and narrow or are wide and irregularly shaped. They are several hundred acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is black and very dark gray loam about 30 inches thick. The upper part of the substratum is brown and yellowish brown, mottled loam. The lower part to a depth of about 60 inches is mottled yellowish brown and light brownish gray sandy loam.

Included with this soil in mapping are areas of recently deposited sand. These areas occur as sandbars or sandy beaches. Also included are areas of gravelly sand, which are lower in organic matter content than the Spillville soil and are more frequently flooded. Included areas are along the stream channels. They make up about 10 percent of the unit.

Permeability is moderate in the Spillville soil, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 5 percent. Reaction typically is neutral to medium acid throughout the profile. The soil generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled.

This soil generally is not suited to cultivation unless it is protected by levees. Land leveling and a surface drainage system are needed in some areas before oxbows and sloughs can be crossed by farm equipment.

Some areas have been cleared and are used for permanent pasture. Other areas support bushes and scrubby trees. This soil is well suited to woodland and wetland wildlife habitat. Unless major reclamation measures are applied, it is best suited to pasture, woodland, or wildlife habitat.

The land capability classification is Vw.

1585—Spillville-Coland complex, channeled, 0 to 2 percent slopes. These nearly level, moderately well drained to poorly drained soils are on flood plains along the larger streams and their tributaries. They are frequently flooded. The landscape generally is cut by many stream channels. As a result, escarpments are common on the higher alluvial terraces. Oxbows and marshy areas are below most of the escarpments. Areas are long and narrow or are wide and irregularly shaped. They are several hundred acres in size. They are about 50 percent Spillville soil and 40 percent Coland soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the Spillville soil has a surface layer of black loam about 7 inches thick. The subsurface layer is black and very dark gray loam about 34 inches thick. The upper part of the substratum is brown, mottled loam. The lower part to a depth of about 60 inches is mottled yellowish brown and light brownish gray sandy loam.

Typically, the Coland soil has a surface layer of black clay loam about 9 inches thick. The subsurface layer is black, mottled clay loam about 20 inches thick. The upper part of the substratum is gray and very dark gray clay loam mottled with olive brown. The lower part to a depth of about 60 inches is gray gravelly loamy sand.

Included with these soils in mapping are areas of highly stratified, recently deposited alluvial sediments that have not been in place long enough for a soil profile to form. These sediments typically are sandy loam or loamy sand. Their organic matter content, permeability, available water capacity, and shrink-swell potential vary. These included areas generally are neutral or slightly acid. They make up about 10 percent of the unit.

Permeability is moderate in the Spillville and Coland soils, and runoff is slow. Available water capacity is high. The soils have a seasonal high water table. The content of organic matter is about 4 to 6 percent in the surface layer of the Spillville soil and 5 to 7 percent in the surface layer of the Coland soil. The shrink-swell potential is high in the Coland soil. Both soils typically are neutral or medium acid throughout. Their subsurface layer generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable.

These soils generally are unsuitable for cultivated crops unless they are protected by levees. Land leveling and a surface drainage system are needed in some areas before oxbows and sloughs can be crossed by farm equipment.

Some areas have been cleared and are used for permanent pasture. Other areas support bushes and scrubby trees. These soils are well suited to woodland and wetland wildlife habitat. Unless major reclamation measures are applied, they are best suited to pasture, woodland, or wildlife habitat.

The land capability classification is Vw.

5010—Pits, sand and gravel. This map unit consists of borrow pits, gravel pits, and sand pits on alluvial terraces and uplands. About 5 to 20 feet of coarse textured material has been removed from the pits and used primarily as material for roads, driveways, and construction. Some areas have been reshaped, but most have vertical sides that support little or no vegetation.

Most of the pits are no longer used as a source of sand and gravel. They are well suited to wildlife habitat. The ponds produced through dredging could support fish. They could be dangerous as sites for recreation and wildlife habitat, however, because of the steepness of the sides and the variable depth of the water.

One area, south of Manchester along U.S. Highway 20, is still being dredged. It is a pit that is several acres in size, contains water many feet deep, and has steep sides.

No land capability classification is assigned.

5030—Pits, limestone quarries. This map unit consists of pits from which limestone has been quarried, primarily for use as roadbuilding material and as agricultural lime. The pits are 40 feet or more deep and are surrounded by piles of spoil 15 feet or more high. They are irregularly shaped and range from a few acres to 40 acres in size. Some contain water a few to many feet deep and have steep sides.

The spoil surrounding the pits varies in texture but generally is loamy and contains varying amounts of limestone fragments. It is derived from glacial till, eolian material, or a mixture of the two. In some areas it has been leveled and smoothed, but in other areas it is very uneven. In the leveled areas grasses or trees grow reasonably well. The spoil ranges from medium acid to mildly alkaline.

The quarries are well suited to wildlife habitat. Those containing water could support fish. They could be dangerous as sites for recreation and wildlife habitat, however, because of the steepness of the sides and the variable depth of the water. Onsite investigation is needed to determine the hazard.

No land capability classification is assigned.

5040—Orthents, loamy. These nearly level to strongly sloping soils are in borrow areas used as a source of construction material. In some areas the original soil has been removed to a depth of 5 to 20 feet or more, and in other areas 4 to 10 inches of topsoil has been redistributed, commonly in an uneven pattern. The soils range from excessively drained to somewhat poorly drained, depending on the kind of material from which the soils were derived and the extent to which the borrow area is restored. Areas typically range from 6 to 50 acres in size.

Typically, the upper 60 inches is yellowish brown, friable and firm loam. In many areas cobbles and pebbles are common on the surface. In some areas the texture is sandy loam. The surface color ranges from very dark gray to dark brown.

Included with these soils in mapping are small areas of sand. Also included are a few areas that were once dumps or landfills and have now been covered. Included areas make up about 5 percent of the unit.

Permeability varies in the Orthents, depending on the texture and density of the soil material. Runoff ranges from slow to rapid. Available water capacity is moderate or low. Soil that was once buried 5 to 20 feet or more beneath the surface has less pore space and a higher density than the original surface layer. It has not been appreciably affected by the processes of soil formation, such as freezing and thawing. The content of organic matter is very low unless the topsoil has been redistributed throughout the area. As a result, preparing a good seedbed is difficult and drought is a hazard. Reaction typically is moderately alkaline. In most areas these soils have a very low supply of available phosphorus and potassium.

These soils are better suited to small grain and to grasses and legumes for hay and pasture than to row crops. They are suited to row crops only in some areas where the topsoil has been redistributed. Corn and soybeans are grown in these areas. If cultivated crops are grown, erosion is a moderate or severe hazard in the more sloping areas. A system of conservation tillage that turns over as little soil as possible and leaves crop residue on the surface helps to control erosion and stabilize the soils.

No land capability classification is assigned.

5042—Udorthents, gravelly. These are nearly level to strongly sloping soils that have been used in the past as borrow areas or gravel pits. The material removed was dominantly sand and gravel. In some areas the original soil has been removed to a depth of 5 to 20 feet or more. In other areas the surface has been reshaped. The soils range from well drained to excessively drained, depending on the kind of material from which the soils were derived and the extent to which the area has been restored. Areas generally range from 5 to 30 acres in size.

Typically, the upper 60 inches is yellowish brown and strong brown, loose gravelly sand. In some areas the texture is loamy sand or sandy loam. In places 4 to 12 inches of topsoil has been redistributed, commonly in a very uneven pattern. The surface color typically is dark brown or very dark grayish brown.

Permeability typically is rapid, and runoff ranges from slow to rapid. Available water capacity is very low. Soil that was once buried 5 to 20 feet or more beneath the surface has less silt and clay than the original surface layer. It has not been appreciably affected by the processes of soil formation, such as freezing and thawing. The content of organic matter is very low unless the topsoil has been redistributed throughout the area. As a result, preparing a good seedbed is difficult and drought is a hazard. Reaction typically is slightly acid to strongly acid. In most areas these soils have a very low supply of available phosphorus and potassium.

These soils generally are not suited to cultivated crops. The areas where topsoil has been redistributed are better suited than the other areas. They are used for corn and soybeans. The soils are better suited to small grain and to grasses and legumes for hay and pasture than to row crops. If cultivated crops are grown, erosion is a moderate or severe hazard in the more sloping areas. A system of conservation tillage that turns over as little soil as possible and leaves crop residue on the surface helps to control erosion and stabilize the soils.

No land capability classification is assigned.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil economically to produce a sustained high yield of crops. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 218,100 acres in Delaware County, or nearly 60 percent of the total acreage, meets the soil requirements for prime farmland. Nearly all of this prime farmland is used for crops. The crops grown on this land, mainly corn and soybeans, account for an estimated two-thirds of the county's total agricultural income each year.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that have limitations, such as a seasonal high water table, frequent flooding during the growing season, or inadequate rainfall, qualify for prime farmland only in areas where these limitations have been overcome by such measures as drainage, flood control, or irrigation. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

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

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

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

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils are identified, the system of land capability classification used by the Soil Conservation Service is explained, and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1981, about 287,000 acres in Delaware County, or about 78 percent of the total acreage, was used for crop production. About 37,000 acres was pasture, including some rotational pasture and hayland used as pasture.

Corn, legume-grass hay, oats, and soybeans are the principal crops. Most of the permanent pastures are not used as cropland because the soils are too steep or too wet or because limestone outcrops make the soils unsuitable for cultivation. Some pastures have been renovated with legumes and legume-grass mixtures.

The paragraphs that follow describe the management concerns in the areas of the county used for crops or pasture.

Water erosion is a major concern on more than 75 percent of the cropland and pasture in the county. The hazard of erosion is influenced by the slope of the land, the texture and structure of the soil, rainfall, the amount and type of plant cover, and tillage practices. The major soils in the county on which erosion control is needed are Downs, Fayette, Kenyon, Chelsea, Nordness, and Bassett soils.

The loss of soil through erosion is damaging for several reasons. Erosion causes losses of organic matter, nutrients, and water in the soil; the formation of gullies on side slopes; deterioration of soil tilth; and pollution of streams. Loss of the surface layer through erosion decreases productivity because the subsoil is mixed into the plow layer in some soils, such as Kenyon, Bassett, Fayette, Downs, and Dinsdale, and because the rooting depth is reduced in other soils, such as Rockton, Backbone, Whalan, Nordness, and Sogn. Erosion also reduces the productivity of droughty soils, such as Sparta, Chelsea, Dickinson, Flagler, and Finchford. Control of erosion helps to maintain productivity. It also improves tilth and water quality for municipal use, recreation, and fish and other wildlife by minimizing the pollution and siltation of streams.

Preparing a good seedbed and tilling are difficult on severely eroded soils because the original friable surface layer is eroded away and the less fertile subsoil is exposed. The severely eroded Fayette soils become hard and cloddy if worked when wet.

Erosion control provides a protective cover, which reduces the runoff rate and increases the rate of water infiltration. A cropping system that keeps a plant cover on the surface for extended periods can hold soil losses to amounts that do not reduce the productive capacity of the soil. On livestock farms, parts of which are used as hayland and pasture, including legumes and grasses in the cropping sequence reduces the susceptibility to erosion on sloping land and improves tilth for the following crop. The legumes also provide additional nitrogen.

A system of conservation tillage that leaves crop residue on the surface is effective in controlling erosion. Following are examples of conservation tillage systems. No-till is a system in which the seedbed is prepared and the seed planted in one operation. The surface is disturbed only in the immediate area of the planted seed row. A protective cover of crop residue is left on at least 90 percent of the surface. Strip-till or till-plant also is a system in which the seedbed is prepared and the seed planted in one operation. Tillage is limited to a strip not wider than one-third of the row width. A protective cover is left on two-thirds of the surface after planting. Both the no-till and strip-till or till-plant systems can be adapted to most of the soils in the county. They cannot be easily applied, however, on soils that have a clayey surface layer. Chisel-disk or rotary tillage is a system in which the soil is loosened throughout the field and part of the crop residue is incorporated into the soil. Preparing the seedbed and planting may be one or several operations. Conservation tillage is effective only if the amount of crop residue left on the surface after planting is enough to control erosion.

Contour farming and contour stripcropping help to control erosion in many areas in the county. They are best suited to soils that have smooth, uniform slopes, such as Fayette, Downs, and Tama soils and some areas of Kenyon soils.

Terraces and diversions generally shorten the length of the slopes and thus reduce the runoff rate and the erosion hazard. They are most practical in deep, well drained soils that have uniform, long slopes. Fayette, Downs, and Tama soils are well suited to terraces and diversions. Kenyon and Bassett soils are less well suited because the slopes are shorter and are irregular. Dickinson, Sparta, Chelsea, and Olin soils are not suited because they have coarse textured material. Rockton, Whalan, Backbone, and Bertram soils are not suited to terraces because they are moderately deep over limestone bedrock. A conservation tillage system that leaves crop residue on the surface is effective in controlling erosion on these soils.

Controlling erosion is difficult on Bassett, Kenyon, and Olin soils because the loamy upper part of these soils is more rapidly permeable than the glacial till in the lower part of the subsoil and in the substratum. Water tends to move more rapidly through the upper part and accumulates at the point where the loamy upper part comes in contact with the glacial till. As a result, hillside seepage can occur during wet periods. A combination of terracing and tiling is likely to be most successful in controlling erosion. Grade stabilization structures and grassed waterways are used to control gullying in watercourses.

Soil blowing is a hazard on the sandy or moderately coarse textured soils, such as Chelsea, Sparta, Dickinson, and Olin. It can be controlled by a plant cover, surface mulch, or conservation tillage systems that keep the surface rough.

Soil drainage is a major management concern in the poorly drained and somewhat poorly drained soils in the county. These soils make up about 25 percent of the total acreage in the county. A subsurface drainage system reduces the wetness of bottom land soils, such as Colo, Spillville, Marshan, and Ossian. It also is needed in upland soils, such as Ely, Clyde, Floyd, Schley, and Sawmill.

The design of both surface and subsurface drainage systems varies with the kind of soil. In most areas of poorly drained and somewhat poorly drained soils that are intensively row cropped, a surface drainage system and measures that control the runoff from higher upland slopes are needed. Drains should be spaced more closely in soils that are moderately slowly permeable than in the more rapidly permeable soils.

Organic soils oxidize and subside when the pore space is filled with air. As a result, special drainage systems are needed to control the depth and the period of drainage in Palms soils. Keeping the water table at the level required by the crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and subsidence of these soils.

Soil fertility is affected by the supply of available phosphorus and potassium in the subsoil, by reaction, and by organic matter content. The supply of available phosphorus and potassium is low or very low in most of the soils in Delaware County. Fayette soils, however, have a high supply of available phosphorus, and Downs and Tama soils have a medium supply.

Most of the upland soils have an acid subsoil. Applications of ground limestone are needed to raise the pH level sufficiently for alfalfa and other crops to grow well. The somewhat poorly drained Floyd soils generally have a neutral subsoil.

In most of the medium textured, well drained or moderately well drained upland soils that formed under forest vegetation, the content of organic matter is about 1 to 2 percent in the surface layer. Examples are Fayette, Dubuque, Coggon, and Nordness soils. In the surface layer of eroded soils, the content of organic matter is generally less than 1 percent. It is 2 to 3 percent in Downs, Bassett, and other medium textured, well drained or moderately well drained soils that formed under a mixture of forest vegetation and grasses. It is 3 to 4 percent in Kenyon, Tama, Dinsdale, and other medium textured, well drained or moderately well drained soils that formed under grasses. It generally is less than 2 percent in Dickinson, Olin, and other coarse textured, well drained soils that formed under grasses. It ranges from 5 to 9 percent in Clyde, Floyd, Sawmill, and other poorly drained or somewhat poorly drained soils on uplands. It is more than 30 percent in Palms soils.

The soils that formed in alluvium generally have a low or very low supply of available phosphorus and potassium in the subsoil. The poorly drained Colo and well drained Worthen soils, however, have a medium supply of available phosphorus. Reaction of alluvial soils typically is slightly acid but ranges from neutral to strongly acid. Organic matter content ranges from 2 percent in the well drained Worthen soils to 7 percent in the poorly drained Ossian soils.

Plants growing on Aredale, Bassett, Dinsdale, Downs, Fayette, Kenyon, and Tama soils respond well to a high level of management and to applications of fertilizer. Applications of lime and fertilizer should be based on the results of soil tests, the needs of the crop, and the expected level of yields. The local offices of the Soil Conservation Service and the Cooperative Extension Service can help to determine the kinds and amounts of fertilizer and lime needed.

Soil tilth is an important factor in the germination of seeds and the infiltration of water into the soil. Soils that have good tilth generally are high in organic matter content, have granular structure, and are porous.

Many of the soils in the county have a dark surface layer that is high in content of organic matter. Soils that are low in content of organic matter generally have weak structure. During periods of intense rainfall, a crust forms on the surface of these soils. This crusting reduces the rate of water infiltration and increases the runoff rate. Regular additions of crop residue, manure, and other organic material improve soil structure and help to prevent crusting.

Fall plowing generally is not desirable on the soils in the county because it increases the susceptibility to water erosion during periods of snow melt and heavy rainfall. It also increases the hazard of soil blowing because the soils are not protected by cover crops.

Pasture and hay crops that are suited to the soils and climate in the county include several legumes, cool-season grasses, and warm-season grasses. Most of the permanent pastures support bluegrass or bromegrass. Other cool-season grasses that are well suited to the soils and climate in the county are orchardgrass, tall fescue, timothy, and reed canarygrass.

Alfalfa is the most common legume grown for hay. It is also used in mixtures with orchardgrass, bromegrass, or timothy for hay and pasture. Birdsfoot trefoil is used in mixtures of bluegrass, orchardgrass, or timothy for pasture. Other legumes that can be grown for pasture are crownvetch, ladino, alsike clover, and red clover.

Warm-season grasses suited to the soils and climate in the county are switchgrass, big bluestem, and indiangrass. These grasses grow well during the warm summer months, but a special management system is needed for establishing and grazing the pasture.

Good grazing management is needed to maintain the productivity of all pasture species. It is especially important in areas of steeply sloping soils, where it helps to prevent surface compaction and gully erosion. On established stands, it includes applications of fertilizer, weed and brush control, rotation or deferred grazing, proper stocking rates, and adequate livestock watering facilities.

If cultivated crops are to be grown before pasture species are seeded, excessive soil losses can be prevented by conservation tillage, contour farming, and grassed waterways. Also, interseeding grasses and legumes into the existing sod and no-till planting eliminate the need for destroying the plant cover during seedbed preparation.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the

Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are 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 or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, 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 only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

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

Woodland Management and Productivity

Trees formerly covered about 110,000 acres in Delaware County, or nearly 30 percent of the total acreage. They were valued by the early settlers as sources of building material and fuel. The settlers harvested the best trees and left the less desirable ones. Gradually, the less desirable ones dominated the woodland. From the time of the early settlers to the present, the woodland has been cleared for agricultural uses. This trend has diminished the flourishing forests to scattered residual forest stands, which cover only about 20,000 acres, or 5 percent of the county. Most of the woodland soils, notably Fayette, Chelsea, Seaton, and Exette, are in areas where the forests once flourished. Some of these soils are severely eroded. Replanting of suitable trees is needed to control erosion on these soils.

The major forested areas in the county are along the Maquoketa River, the Little Turkey River and its major tributaries, the North Fork of the Maquoketa River, and Elk Creek. In many areas the soils adjacent to these watercourses are unsuitable for cultivation and are poorly suited to pasture because they are too steep or are too shallow to limestone bedrock. The woodland in these areas is extremely important because the cover of trees helps to control erosion.

Good woodland management is critical in these areas and in other wooded areas in the county. It keeps the woodland productive. It includes measures that protect the woodland from livestock and fire. It also includes planting, weeding, thinning, and pruning. Good harvesting techniques help to sustain productivity. In uneven-aged stands, the best technique generally is selective cutting. In even-aged stands, seed-tree and shelterwood harvesting methods are suitable. High grading should be avoided in any stand of trees. This method leaves only the undesirable and poorly formed trees for regeneration of the stand.

The management of a wooded area depends on the present condition of the woodland and the kinds of trees to be grown. The objective of woodland management is to attain sustained production by cutting only the amount of wood that the stand produces in a given period of time. These cuttings can be made every 5 to 10 years.

The factors that affect the use of soils for woodland are somewhat different and less restrictive than those that affect the use of soils for cropland. This soil survey can help the woodland owner identify the soils that are most likely to be productive as woodland. Some factors that affect woodland management are described in the following paragraphs.

Soil moisture.—The growth of trees is directly related to the available water capacity of the soil. Available water capacity is determined mainly by slope, soil depth, permeability, and internal drainage. A lack of sufficient moisture is a limiting factor in Chelsea, Dubuque, Lamont, Nordness, and Whalan soils.

Aspect, or direction of slope.—The exposure of a soil to sunlight affects the types of trees that can grow on a site and the rate of growth. South- and west-facing slopes in areas of Fayette, Nordness, and other soils tend to be warmer and drier than north- and east-facing slopes.

Soil reaction.—This factor to some degree affects the growth rate and the suitability of tree species. Most pines grow better on soils that tend to be more acid. In contrast, hardwoods grow better on soils that tend to be neutral. Pines grow better than hardwoods on the eroded or depleted soils in Delaware County because these soils tend to be medium acid or strongly acid in the subsurface layer and the subsoil. Some areas of hardwoods are depleted and eroded because of overcutting and overgrazing. These areas should be planted to conifers. Before the conifers are planted, competing trees and shrubs should be removed by mowing or by applications of chemicals.

The local office of the Soil Conservation Service can help woodland managers determine which soils are suitable for trees, the best land use for wooded areas, and the kinds of management needed. State foresters can assist in developing plans for managing new or existing stands.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. It is based on the site index of the species listed first in the *common trees* column. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *r* indicates steep slopes; *x*, stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted rooting depth; *c*, clay in the upper part of the soil; *s*, sandy texture; and *f*, high content of coarse fragments in the soil profile. The letter *a* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: r, x, w, t, d, c, s, and f.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

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

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, reduce energy requirements, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Delaware County has a varied population of wildlife. The principal game species are white-tailed deer, ring-necked pheasant, ruffed grouse, turkey, and squirrels. Fish are abundant in the major rivers and stocked streams. Smallmouth bass, catfish, northern pike, sunfish, and rough fish inhabit the Maquoketa River and the North Fork of the Maquoketa River. The stocked streams are inhabited by brook, brown, and rainbow trout. Some farm ponds are stocked with bluegills, crappies, bullheads, and largemouth bass.

Woodland wildlife habitat at one time was excellent in the county. Clearing of the woodland for agricultural uses and overharvesting of trees, however, have drastically reduced the number of acres of prime woodland habitat. Most of the remaining woodland wildlife habitat is in areas of the Fayette-Nordness-Rock outcrop and the Fayette-Chelsea soil associations, which are described under the heading "General Soil Map Units." White-tailed deer, turkey, ruffed grouse, and squirrels depend on woodland habitat for food and protection. Woodland habitat can be improved by fencing out livestock and protecting the woodland from fire. In some areas plantings for wildlife are needed to improve the habitat and to provide food.

Wetland wildlife habitat has been reduced in extent because of the drainage of wetlands and the destruction of wetland plants, shrubs, and trees. Runoff from feedlots and fields has reduced the numbers and types of wetland plant and animal species. Erosion causes siltation of the streams, and the runoff from fields contains some herbicides, which can destroy aquatic and wetland plants. Great blue heron, American egret, mallards, teal, beaver, muskrat, mink, and otter are a few of the species that depend on wetland areas. Most of the wetland habitat in the county is in areas of the Spillville-Saude-Marshan soil association. Wetland habitat can be improved by allowing the native grasses and shrubs to grow along streambanks and by fencing livestock out of the wetland areas. Diverting runoff from adjacent upland areas away from wetlands helps to ensure that applied chemicals do not harm the wetland plants and animals.

The Kenyon-Clyde-Floyd and the Nordness-Backbone-Bassett soil associations provide most of the openland wildlife habitat in the county. The principal game species in areas of openland habitat is ring-necked pheasant. Openland habitat is limited to road ditches, to areas along fence lines, and to occasional clumps of grasses and shrubs in fields where limestone crops out. These areas can sustain only a limited number of pheasants. Nesting cover and winter cover are the most critical factors affecting the pheasant population. If the plant cover in ditches and along fence lines is left unclipped until early in the summer, the pheasant population can be significantly increased. Winter cover can be provided by farmstead windbreaks and wildlife plantings. Leaving a few rows of grain near these areas helps to provide an excellent source of winter food.

Wildlife diversity depends on habitat diversity. It can be best achieved by the edge effect created, for example, by a strip of grasses and legumes near a wooded area or a wetland area. Some types of wildlife depend on different kinds of habitat at different times of the year. Quail is an example. The strips of grasses and legumes can be used by other nesting birds and animals, such as the plovers, rabbits, ring-necked pheasant, and certain waterfowl.

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

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

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

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, orchardgrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

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

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

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

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

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

Engineering

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

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

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

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

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

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

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

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

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of calcium carbonate affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

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

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

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

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

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

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

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

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

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

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

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

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

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

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

Soil Properties

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

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

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

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

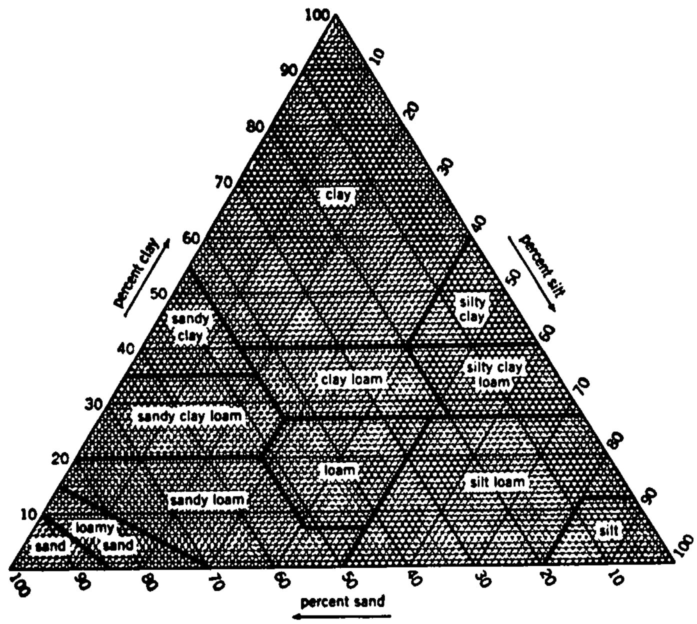


Figure 12.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 12). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

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

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

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

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

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

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

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

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

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

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

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

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

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

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

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

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

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

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

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

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

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

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

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

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

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

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

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

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

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

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

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*15*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludolls (*Hapl*, meaning minimal horizonation, plus *udoll*, the suborder of the Mollisols that have a udic moisture regime).

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

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

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

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*14*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*15*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Aredale Series

The Aredale series consists of well drained, moderately permeable soils on convex side slopes and nose slopes in the uplands. These soils formed in loamy and silty sediments 40 to 60 inches deep over glacial till. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Aredale soils are commonly adjacent to Dinsdale and Sawmill soils. Dinsdale soils formed in loess and in the underlying glacial till. They are in positions on the landscape similar to those of the Aredale soils. Sawmill soils are poorly drained and are in upland drainageways.

Typical pedon of Aredale silt loam, 2 to 5 percent slopes; 150 feet east and 2,110 feet north of the southwest corner of sec. 23, T. 90 N., R. 5 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.
A—7 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; mixed with a small amount of brown (10YR 4/3) material; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.
BA—11 to 16 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.
Bw—16 to 28 inches; dark yellowish brown (10YR 4/4) loam; weak medium and fine subangular blocky structure; friable; medium acid; clear smooth boundary.
2BC—28 to 38 inches; yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable; medium acid; clear wavy boundary.
2C1—38 to 55 inches; yellowish brown (10YR 5/6) loamy fine sand; single grained; loose; few dark yellowish brown (10YR 4/4) clay bridges between sand grains; medium acid; abrupt wavy boundary.
3C2—55 to 60 inches; yellowish brown (10YR 5/4) loam; few fine faint strong brown (7.5YR 5/6) mottles; massive; firm; neutral.

The solum ranges from 30 to 48 inches in thickness. It typically is neutral to medium acid. Carbonates typically are not evident to a depth of 5 feet but in some pedons are as shallow as 4 feet in the glacial till.

The A horizon typically is silt loam in which the content of fine sand is 15 to 20 percent. In some pedons, however, the content of fine sand is 5 to 10 percent. This horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The B horizon has hue of 10YR, value of 3 to 5, and chroma of 3 to 6. The texture is silt loam in the BA horizon and grades to loam, fine sandy loam, sandy loam, or loamy sand in the Bw and BC horizons. The 2C horizon is loamy fine sand or fine sandy loam. It has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The 3C horizon is loam or clay loam.

Arenzville Series

The Arenzville series consists of well drained, moderately permeable soils on bottom land and in upland drainageways. These soils formed in silty recent alluvium over an older buried soil. The native vegetation was deciduous trees. Slope ranges from 2 to 5 percent.

Arenzville soils are similar to Chaseburg soils and are commonly adjacent to those soils. Chaseburg soils do not have a buried soil within a depth of 40 inches. They are in landscape positions similar to those of the Arenzville soils.

Typical pedon of Arenzville silt loam, in an area of Arenzville-Chaseburg silt loams, 2 to 5 percent slopes; 2,440 feet west and 320 feet north of the center of sec. 14, T. 90 N., R. 6 W.

A—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam that has thin brown (10YR 5/3) strata; pale brown (10YR 6/3) dry; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.
C1—9 to 25 inches; stratified dark grayish brown (10YR 4/2) and brown (10YR 5/3) silt loam; massive; friable; slightly acid; gradual smooth boundary.
C2—25 to 35 inches; stratified dark grayish brown (10YR 4/2) and brown (10YR 5/3) silt loam that has thin very dark grayish brown (10YR 3/2) strata; massive; friable; slightly acid; abrupt wavy boundary.
Ab—35 to 60 inches; very dark grayish brown (10YR 3/2) silt loam; continuous black (10YR 2/1) coatings on faces of peds; weak fine subangular blocky structure; friable; brown (10YR 5/3) krotovinas at a depth of 42 inches; neutral.

The depth to the Ab horizon ranges from 20 to 40 inches. The content of clay ranges from 10 to 18 percent in the 10- to 40-inch control section. In some pedons it is more than 18 percent in the Ab horizon. Reaction typically is slightly acid but ranges from mildly alkaline to medium acid in some horizons. The color, arrangement, and thickness of all horizons vary, depending on the source of sediments and the method of deposition.

The Ap and C1 horizons typically are dark grayish brown (10YR 4/2) but have strata with value of 3 to 5 and chroma of 3. All C horizons intervening between the Ap or C1 horizon and the Ab horizon are stratified. The C horizon dominantly has hue of 10YR, value of 3 to 6, and chroma of 2 or 3. The Ab horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Material coarser than silt loam occurs only as thin lenses within a depth of 60 inches.

Backbone Series

The Backbone series consists of moderately deep, well drained soils on convex upland ridges and side slopes. These soils formed in loamy sediments and in the underlying loamy or clayey material weathered from limestone. Permeability is moderately rapid in the upper part of the solum and moderately slow in the lower part. The native vegetation was mixed prairie grasses and deciduous trees. Slope ranges from 2 to 9 percent.

Backbone soils are similar to Bertram soils and are commonly adjacent to Goss, Nordness, Rockton, Sogn, and Whalan soils. Bertram soils have a mollic epipedon. Goss soils formed in loamy sediments and in the underlying material weathered from cherty limestone. They are deep. Nordness and Sogn soils are less than 20 inches deep over limestone. Rockton and Whalan soils have less sand in the sediments overlying the limestone than the Backbone soils. Goss, Rockton, and Whalan soils are in landscape positions similar to those of the Backbone soils. Nordness and Sogn soils are on side slopes.

Typical pedon of Backbone fine sandy loam, 2 to 5 percent slopes; 530 feet west and 200 feet south of the northeast corner of sec. 1, T. 90 N., R. 5 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

E—8 to 12 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; discontinuous dark grayish brown (10YR 4/2) coatings on faces of peds; weak thin platy and weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

BE—12 to 23 inches; dark yellowish brown (10YR 4/4) and brown (10YR 4/3) sandy loam; weak medium subangular blocky structure; friable; neutral; gradual smooth boundary.

Bt1—23 to 29 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium and fine subangular blocky structure; friable; thin discontinuous very dark grayish brown (10YR 3/2) clay films; few pebbles 5 to 10 millimeters in size; neutral; clear wavy boundary.

2Bt2—29 to 32 inches; dark brown (7.5YR 3/2) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; thick discontinuous dark grayish brown (10YR 4/2) clay films; neutral; abrupt wavy boundary.

2R—32 inches; hard fractured limestone bedrock.

The thickness of the solum and the depth to limestone bedrock range from 20 to 40 inches. Reaction ranges from neutral to strongly acid throughout the profile.

The A or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 6 to 9 inches thick. The E horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3 or 5/3). It is 2 to 4 inches thick. In some cultivated areas it is wholly incorporated into the Ap horizon. The 2Bt2 horizon is clay loam or clay. It is 2 to 5 inches thick.

Bassett Series

The Bassett series consists of moderately well drained, moderately permeable soils on convex upland ridges and side slopes. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation was mixed prairie grasses and deciduous trees. Slope ranges from 2 to 9 percent.

Bassett soils are similar to Coggon, Cresken, and Kenyon soils and are commonly adjacent to Coggon, Kenyon, Oran, and Schley soils. The A horizon in Coggon soils is thinner than that in the Bassett soils, and the E horizon is more distinct. Cresken and Kenyon soils have a mollic epipedon. Also, Cresken soils have more clay in the underlying glacial till than the Bassett soils. Oran and Schley soils are somewhat poorly drained. Coggon and Kenyon soils are in landscape positions similar to those of the Bassett soils. Oran soils are on broad upland ridges. Schley soils are in upland drainageways.

Typical pedon of Bassett loam, 2 to 5 percent slopes; 1,585 feet north and 595 feet east of the southwest corner of sec. 2, T. 90 N., R. 6 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam (21 percent clay), grayish brown (10YR 5/2) dry; discontinuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular structure; friable; neutral; abrupt smooth boundary.

E—7 to 13 inches; dark grayish brown (10YR 4/2) loam (19 percent clay), light brownish gray (10YR 6/2) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure; friable; light brownish gray (10YR 6/2) dry silt coatings on faces of peds; neutral; clear smooth boundary.

BE—13 to 20 inches; brown (10YR 4/3) loam (20 percent clay); discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid; gradual smooth boundary.

2Bt1—20 to 29 inches; yellowish brown (10YR 5/6) loam (25 percent clay); discontinuous dark yellowish brown (10YR 4/4) coatings on faces of peds; moderate medium subangular blocky structure; firm; discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; common small pebbles in a stone line at a depth of 20 inches; medium acid; gradual smooth boundary.

2Bt2—29 to 35 inches; yellowish brown (10YR 5/6) loam (25 percent clay); discontinuous yellowish brown (10YR 5/4) coatings on faces of peds; moderate medium subangular blocky structure; firm; discontinuous dark brown (7.5YR 3/2) clay films; light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; gradual smooth boundary.

2Bt3—35 to 42 inches; yellowish brown (10YR 5/6) loam (25 percent clay); discontinuous yellowish brown (10YR 5/4) coatings on faces of peds; few fine distinct strong brown (7.5YR 5/8) and few fine faint grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; dark brown (10YR 4/3) clay films; light gray (10YR 7/2) dry silt coatings on faces of peds; few fine black (10YR 2/1) concretions (manganese oxide); strongly acid; clear smooth boundary.

2BC—42 to 50 inches; yellowish brown (10YR 5/6) loam (21 percent clay); discontinuous yellowish brown (10YR 5/4) coatings on faces of peds; common fine distinct strong brown (7.5YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; weak medium prismatic structure; firm; discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

2C—50 to 60 inches; mottled strong brown (7.5YR 5/8) and grayish brown (10YR 5/2) loam (21 percent clay); massive; firm; dark brown (7.5YR 3/2) clay flows in root channels; common fine black (10YR 2/1) concretions (manganese oxide); neutral.

The solum ranges from 40 to 60 inches in thickness. The depth to glacial till ranges from about 14 to 26 inches in uneroded areas.

The A horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 6 to 9 inches thick. In cultivated areas the Ap horizon is very dark grayish brown (10YR 3/2) and is about 6 to 8 inches thick. The E horizon, if it occurs, is dark grayish brown (10YR 4/2) or brown (10YR 4/3). It is 2 to 8 inches thick. In some pedons it is incorporated into the Ap horizon. The BE horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or higher. It has no distinct lower chroma mottles. In some pedons a stone line does not separate the upper loamy material from the underlying glacial till. The 2B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or higher. It has mottles with lower chroma. It typically is loam, but the range includes clay loam and sandy clay loam. This horizon is medium acid to very strongly acid.

Bertram Series

The Bertram series consists of moderately deep, somewhat excessively drained, moderately rapidly permeable soils on convex ridges and side slopes in the uplands. These soils formed in loamy eolian material and, in most areas, the underlying loamy or clayey limestone residuum. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Bertram soils are similar to Backbone soils and are commonly adjacent to Nordness, Rockton, and Sogn soils. Backbone soils do not have a mollic epipedon. Nordness and Sogn soils are less than 20 inches deep over limestone. Rockton soils do not have a sandy loam texture above the limestone. Nordness soils are on side slopes. Rockton and Sogn soils are in landscape positions similar to those of the Bertram soils.

Typical pedon of Bertram fine sandy loam, 2 to 5 percent slopes; 200 feet east and 760 feet south of the northwest corner of sec. 15, T. 89 N., R. 5 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A—7 to 16 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular structure; friable; slightly acid; gradual smooth boundary.

AB—16 to 20 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; discontinuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Bw—20 to 29 inches; dark brown (10YR 4/3 and 3/3) sandy loam; weak fine subangular blocky structure; friable; medium acid; abrupt wavy boundary.

2Bt—29 to 34 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate fine subangular blocky structure; friable; strong brown (7.5YR 4/6) partially weathered limestone in the lower 2 inches; discontinuous dark brown (7.5YR 3/2) clay films; slightly acid; abrupt wavy boundary.

2R—34 inches; fractured level-bedded limestone bedrock.

The thickness of the solum and the depth to limestone bedrock range from 20 to 40 inches. They generally decrease as slope increases. The surface soil ranges from 14 to 24 inches in thickness.

The Ap or A horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). The Bw horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4. It typically is sandy loam, but in some pedons it has thin strata of loamy sand in the lower part. The 2Bt horizon is sandy clay loam or clay loam. It is 2 to 6 inches thick.

Bertrand Series

The Bertrand series consists of well drained soils on alluvial terraces. These soils formed in silty alluvium 40 to 60 inches deep over stratified, sandy alluvium. Permeability is moderate in the solum and rapid in the substratum. The native vegetation was deciduous trees. Slope ranges from 0 to 2 percent.

Bertrand soils are commonly adjacent to Fayette, Richwood, Rowley, and Tell soils. Fayette soils formed in deep loess on uplands. Richwood and Rowley are in landscape positions similar to those of the Bertrand soils. They have a mollic epipedon. Also, Rowley soils are somewhat poorly drained. Tell soils formed dominantly in silty material 20 to 40 inches deep over sand and loamy sand. They are on uplands and alluvial terraces.

Typical pedon of Bertrand silt loam, 0 to 2 percent slopes; 850 feet west and 380 feet south of the northeast corner of sec. 15, T. 87 N., R. 4 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam (15 percent clay), light brownish gray (10YR 6/2) dry; mixed with some streaks and pockets of brown (10YR 5/3) subsurface material; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

E—7 to 13 inches; brown (10YR 5/3) silt loam (15 percent clay), very pale brown (10YR 7/3) dry; continuous dark grayish brown (10YR 4/2) coatings on faces of peds; weak thin platy structure; friable; medium acid; clear smooth boundary.

BE—13 to 19 inches; yellowish brown (10YR 5/4) silt loam (21 percent clay); moderate fine subangular blocky structure; friable; discontinuous brown (7.5YR 4/4) clay films; light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid; clear smooth boundary.

Bt1—19 to 28 inches; yellowish brown (10YR 5/4) silt loam (26 percent clay); moderate fine angular and subangular blocky structure; friable; discontinuous dark brown (7.5YR 3/2) and brown (7.5YR 4/4) clay films; light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid; clear smooth boundary.

Bt2—28 to 38 inches; yellowish brown (10YR 5/4) silty clay loam (29 percent clay); moderate fine angular and subangular blocky structure; friable; continuous brown (7.5YR 4/4) clay films; light gray (10YR 7/1) dry silt coatings on faces of peds; few strong brown (7.5YR 4/6) oxides; strongly acid; clear smooth boundary.

Bt3—38 to 47 inches; yellowish brown (10YR 5/4) silt loam (26 percent clay); weak fine prismatic structure; friable; discontinuous dark yellowish brown (10YR 4/4) and dark brown (7.5YR 3/2) clay films; light gray (10YR 7/1) dry silt coatings on faces of peds; few black (10YR 2/1) and strong brown (7.5YR 4/6) oxides; strongly acid; gradual smooth boundary.

C—47 to 60 inches; yellowish brown (10YR 5/4) silt loam (21 percent clay); few fine faint grayish brown (10YR 5/2) mottles; appears massive but has weak bedding planes; friable; few dark yellowish brown (10YR 4/4) clay flows in root channels; few black (10YR 2/1) oxides; strongly acid.

The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3). The A horizon, if it occurs, is about 4 inches thick. It is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1). The E horizon is dark grayish brown (10YR 4/2) or brown (10YR 5/3). The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The solum typically has mottles below a depth 30 inches. Reaction ranges from slightly acid in the upper part of the B horizon to very strongly acid in the lower part. Some pedons have a 2C horizon, which is stratified loam, sandy loam, loamy sand, or gravelly sandy clay loam.

Bolan Series

The Bolan series consists of well drained soils on convex upland ridges. These soils formed in loamy eolian material 30 to 48 inches deep over sandy eolian material. Permeability is moderate in the upper part of the solum and rapid in the substratum. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Bolan soils are similar to Dickinson soils and are commonly adjacent to Clyde, Floyd, and Schley soils. Dickinson soils have more sand in the upper 20 to 30 inches than the Bolan soils. The poorly drained Clyde and somewhat poorly drained Floyd and Schley soils are in broad drainageways.

Typical pedon of Bolan loam, 2 to 5 percent slopes; 1,420 feet south and 925 feet west of the center of sec. 34, T. 87 N., R. 5 W.

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

A—8 to 14 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky and weak fine granular structure; friable; neutral; clear smooth boundary.

AB—14 to 20 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; discontinuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw—20 to 28 inches; brown (10YR 4/3) loam; dark brown (10YR 3/3) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

BC—28 to 41 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; medium acid; gradual smooth boundary.

2C1—41 to 49 inches; yellowish brown (10YR 5/4) loamy fine sand; single grained; loose; medium acid; gradual smooth boundary.

2C2—49 to 60 inches; yellowish brown (10YR 5/4 and 5/6) fine sand; single grained; loose; medium acid.

The solum ranges from 30 to 48 inches in thickness. It typically is neutral to medium acid. Carbonates typically are not evident to a depth of 5 feet but in some pedons are as shallow as 4 feet.

The A horizon typically is loam, but the range includes silt loam high in content of sand. This horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The B and BC horizons are loam or fine sandy loam. They have hue of 10YR, value of 3 to 6, and chroma of 4 to 6. The 2C horizon is loamy fine sand or fine sand. It has hue of 10YR, value of 4 or 5, and chroma of 3 to 6.

Burkhardt Series

The Burkhardt series consists of somewhat excessively drained soils on upland ridgetops and alluvial terraces. These soils formed in loamy and sandy sediments 12 to 24 inches deep over sand and gravel. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. The native vegetation was prairie grasses. Slope ranges from 2 to 5 percent.

Burkhardt soils are commonly adjacent to Flagler, Saude, and Sparta soils. The adjacent soils are in landscape positions similar to those of the Burkhardt soils. Flagler soils are 20 to 40 inches over sand and gravel. Saude soils have less sand in the A horizon and the upper part of the B horizon than the Burkhardt soils. Sparta soils have more sand in the A horizon than the Burkhardt soils and do not have gravel in the substratum.

Typical pedon of Burkhardt sandy loam, in an area of the Burkhardt-Saude complex, 2 to 5 percent slopes; 925 feet west and 395 feet south of the center of sec. 9, T. 89 N., R. 6 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; very friable; slightly acid; abrupt smooth boundary.

A—7 to 13 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; very friable; medium acid; clear smooth boundary.

Bw—13 to 17 inches; dark brown (10YR 3/3) sandy loam; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; very friable; medium acid; clear smooth boundary.

BC—17 to 22 inches; brown (10YR 4/3) loamy sand; single grained; loose; estimated 10 percent gravel; strongly acid; gradual smooth boundary.

2C1—22 to 33 inches; brown (7.5YR 4/4) sand; single grained; loose; estimated 15 percent gravel; strongly acid; gradual smooth boundary.

2C2—33 to 60 inches; dark yellowish brown (10YR 4/6) coarse sand and gravel; single grained; loose; strongly acid.

The solum ranges from 12 to 24 inches in thickness. It is underlain by stratified or mixed sand and gravel. In most pedons the greatest concentration of gravel-size material is at a depth of 60 inches or less.

The A horizon typically is sandy loam, but the range includes loam and gravelly sandy loam. This horizon is very dark grayish brown (10YR 3/2), dark brown (10YR 3/3), or very dark brown (10YR 2/2). The B horizon typically is sandy loam, but the range includes loamy sand, gravelly sandy loam, and gravelly loamy sand. The 2C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6.

Chaseburg Series

The Chaseburg series consists of well drained and moderately well drained, moderately permeable soils that formed in silty alluvium in upland drainageways and on alluvial fans. The native vegetation was deciduous trees. Slope ranges from 2 to 5 percent.

Chaseburg soils are similar to Arenzville soils and are commonly adjacent to Arenzville and Fayette soils. Arenzville soils have a dark Ab horizon at a depth of 20 to 40 inches. They are in landscape positions similar to those of the Chaseburg soils. Fayette soils formed in loess on the steeper upland side slopes.

Typical pedon of Chaseburg silt loam, in an area of Arenzville-Chaseburg silt loams, 2 to 5 percent slopes; 2,440 feet west and 200 feet north of the center of sec. 14, T. 90 N., R. 6 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

C1—8 to 20 inches; dark grayish brown (10YR 4/2) silt loam; few thin brown (10YR 5/3) strata; massive; friable; neutral; gradual smooth boundary.

C2—20 to 51 inches; dark grayish brown (10YR 4/2) silt loam; common thin brown (10YR 5/3) and very dark grayish brown (10YR 3/2) strata; massive; friable; neutral; clear smooth boundary.

C3—51 to 60 inches; dark grayish brown (10YR 4/2) silt loam; common thin brown (10YR 5/3) and grayish brown (10YR 5/2) strata; massive; friable; few fine black (10YR 2/1) and reddish brown (5YR 4/4) concretions (manganese and iron oxides); neutral.

The control section is slightly acid or neutral in the upper part and medium acid to neutral in the lower part. The Ap horizon typically is dark grayish brown (10YR 4/2) but in some pedons is grayish brown (10YR 5/2). The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. In some pedons it has very dark grayish brown (10YR 3/2) strata.

Chelsea Series

The Chelsea series consists of excessively drained, rapidly permeable soils that formed in eolian sand. These soils generally are on ridges and side slopes in the uplands but in a few areas are on alluvial terraces. The native vegetation was deciduous trees. Slope ranges from 2 to 18 percent.

Chelsea soils are commonly adjacent to Backbone, Fayette, Goss, Lamont, and Seaton soils. The adjacent soils are in landscape positions similar to those of the Chelsea soils. Backbone soils have limestone bedrock at a depth of 20 to 40 inches. Fayette soils formed in loess and are silt loam or silty clay loam throughout. Goss soils formed in loamy sediments and in the underlying material weathered from cherty limestone. Lamont soils have less sand in the upper part of the solum than the Chelsea soils. Seaton soils formed in loess and are silt loam throughout.

Typical pedon of Chelsea loamy fine sand, 5 to 9 percent slopes; 150 feet east and 1,600 feet south of the northwest corner of sec. 16, T. 90 N., R. 6 W.

A—0 to 4 inches; very dark gray (10YR 3/1) loamy fine sand (85 percent sand), gray (10YR 5/1) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

E1—4 to 8 inches; brown (10YR 4/3) loamy fine sand (85 percent sand), grayish brown (10YR 5/2) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure; very friable; medium acid; clear smooth boundary.

E2—8 to 27 inches; yellowish brown (10YR 5/4) loamy fine sand (85 percent sand), very pale brown (10YR 7/4) dry; weak thick platy structure; very friable; few pores, one-third inch in diameter, with continuous very dark grayish brown (10YR 3/2) coatings; medium acid; gradual smooth boundary.

E3—27 to 37 inches; yellowish brown (10YR 5/4) loamy fine sand (85 percent sand), very pale brown (10YR 7/3) dry; single grained; loose; medium acid; gradual smooth boundary.

E&Bt—37 to 60 inches; yellowish brown (10YR 5/6) fine sand (E); single grained; loose; 1/4- to 2-inch brown (7.5YR 5/4) loamy sand (Bt) bands at depths of 37, 43, 50, and 56 inches; single grained; loose; medium acid.

The thickness of the solum ranges from 4 to 8 feet. The sand is dominantly fine sand. The soils are medium acid or strongly acid in the most acid part.

The A horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 2 to 6 inches thick. It is dominantly loamy fine sand, but the range includes fine sand. The Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 3/3), or brown (10YR 4/3). The E horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. It has weak thin to thick platy structure in the upper part and is single grained or has weak thick platy structure in the lower part. The E part of the E&Bt horizon is yellowish brown (10YR 5/6) to brown (10YR 4/3) sand or fine sand. The B part occurs as iron bands that are 1/4 inch to 2 inches thick, have hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 6, and are sandy loam or loamy sand.

Clyde Series

The Clyde series consists of poorly drained, moderately permeable soils in upland drainageways. These soils formed in loamy sediments and in the underlying glacial till. A band of pebbles commonly separates the glacial till and the overlying material. The native vegetation was water-tolerant grasses. Slope ranges from 0 to 4 percent.

Clyde soils are similar to Floyd soils and are commonly adjacent to Bolan, Floyd, Kenyon, and Oran soils. Floyd soils are on concave foot slopes above the Clyde soils and are somewhat poorly drained. Bolan and Kenyon soils are in convex areas on ridges and side slopes and are higher on the landscape than the Clyde soils. Also, Bolan soils have more sand throughout the solum. They are well drained. Kenyon soils are moderately well drained. Oran soils are somewhat poorly drained and are on upland ridgetops. They do not have a mollic epipedon.

Typical pedon of Clyde clay loam, in an area of Clyde-Floyd complex, 1 to 4 percent slopes; 1,135 feet east and 132 feet south of the northwest corner of sec. 16, T. 88 N., R. 6 W.

A—0 to 17 inches; black (N 2/0) clay loam, very dark gray (N 3/0) dry; weak fine granular structure; friable; neutral; gradual smooth boundary.

AB—17 to 23 inches; black (5Y 2/1) clay loam, very dark gray (5Y 3/1) dry; common fine distinct dark gray (5Y 4/1) and few fine faint light olive brown (2.5Y 5/4) mottles; weak fine granular and weak very fine subangular blocky structure; friable; few dark reddish brown (5YR 2/2) concretions (iron oxide); slightly acid; clear smooth boundary.

Bg—23 to 29 inches; gray (5Y 5/1) loam; common fine distinct dark gray (5Y 4/1) and yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

BCg1—29 to 34 inches; mottled gray (5Y 5/1) and yellowish brown (10YR 5/8) loam; few fine distinct dark gray (5Y 4/1) mottles; weak fine subangular blocky structure; friable; few dark red (2.5YR 3/6) concretions (iron oxide); 1-inch sand stratum at a depth of 33 inches; slightly acid; abrupt smooth boundary.

2BCg2—34 to 41 inches; gray (5Y 5/1) loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; slightly acid; gradual smooth boundary.

2C—41 to 60 inches; mottled gray (5Y 5/1) and yellowish brown (10YR 5/8) loam; massive; firm; neutral.

The solum typically is more than 40 inches thick but ranges from 30 to 60 inches. It is neutral or slightly acid. The depth of erosional sediments or glacial outwash over glacial till typically is about 34 inches but ranges from 30 to 50 inches. The depth to carbonates ranges from about 45 to more than 60 inches.

The A horizon typically is clay loam, but the range includes silty clay loam that is high in content of sand. It also includes loam. This horizon is 18 to 24 inches thick. The Bg and BCg horizons have hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The Bg horizon is dominantly loam, silty clay loam, or clay loam, but some pedons have thin strata of sandy loam or loamy sand, typically less than 6 inches thick.

Coggon Series

The Coggon series consists of moderately well drained, moderately permeable soils on convex ridgetops and side slopes in the uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation was deciduous trees. Slope ranges from 2 to 5 percent.

Coggon soils are similar to Bassett soils and are commonly adjacent to Bassett, Schley, and Whalan soils. The A horizon of Bassett is thicker and darker than that of the Coggon soils. Schley soils are somewhat poorly drained and are deeper to glacial till than the Coggon soils. Whalan soils have limestone bedrock at a depth of 20 to 40 inches. Bassett and Whalan soils are in landscape positions similar to those of the Coggon soils. Schley soils are in upland waterways.

Typical pedon of Coggon loam, 2 to 5 percent slopes; 1,495 feet west and 200 feet north of the southeast corner of sec. 26, T. 90 N., R. 6 W.

A—0 to 3 inches; black (10YR 2/1) loam (20 percent clay), dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

E1—3 to 8 inches; dark grayish brown (10YR 4/2) loam (20 percent clay), light brownish gray (10YR 6/2) dry; mixed with black (10YR 2/1) material from the A horizon; weak thin platy structure; friable; slightly acid; gradual smooth boundary.

E2—8 to 13 inches; brown (10YR 4/3) loam (20 percent clay), pale brown (10YR 6/3) dry; weak thin platy structure parting to weak fine subangular blocky; friable; black (10YR 2/1) coatings in wormholes; medium acid; gradual smooth boundary.

BE—13 to 20 inches; yellowish brown (10YR 5/4) loam (21 percent clay); weak fine subangular blocky structure; friable; many stones in the lower part; strongly acid; gradual smooth boundary.

2Bt1—20 to 29 inches; yellowish brown (10YR 5/4) loam (26 percent clay); few fine faint yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; strongly acid; gradual smooth boundary.

2Bt2—29 to 40 inches; yellowish brown (10YR 5/4) loam (26 percent clay); few fine distinct strong brown (7.5YR 5/8) and grayish brown (10YR 5/2) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; light brownish gray (10YR 6/2) silt coatings on prism faces; strongly acid; gradual smooth boundary.

2Bt3—40 to 50 inches; mottled yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) loam (26 percent clay); few fine distinct strong brown (7.5YR 5/8) mottles; weak medium prismatic structure; firm; thin discontinuous brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; gradual smooth boundary.

2C—50 to 60 inches; mottled yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) loam (21 percent clay); few fine distinct strong brown (7.5YR 5/8) mottles; massive; firm; thin discontinuous brown (7.5YR 4/4) clay films in root channels; black (10YR 2/1) concretions (manganese oxide); medium acid.

The solum ranges from 50 to 70 inches in thickness. The depth to glacial till ranges from 14 to 26 inches.

The A horizon is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2) loam. It is 2 to 5 inches thick. The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The E horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or brown (10YR 4/3). It ranges from 3 to 14 inches in thickness. In some pedons it is incorporated into the A horizon. The BE horizon is brown (10YR 4/3) or yellowish brown (10YR 5/4). It typically has a stone line. The 2Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 6. It typically has strong brown (7.5YR 5/8) and grayish brown (10YR 5/2) mottles.

Coland Series

The Coland series consists of poorly drained, moderately permeable soils on bottom land. These soils formed in loamy alluvial material. The native vegetation was water-tolerant grasses. Slope ranges from 0 to 2 percent.

Coland soils are similar to Spillville soils and are commonly adjacent to Lawler, Marshan, and Spillville soils. Spillville soils are moderately well drained and somewhat poorly drained. They are closer to the major streams than the Coland soils. Also, they have less clay throughout the solum. Lawler and Marshan soils have sand and gravel at a depth of 20 to 40 inches. They are on alluvial terraces. Lawler soils are somewhat poorly drained.

Typical pedon of Coland clay loam, in an area of Spillville-Coland complex, 0 to 2 percent slopes; 924 feet west and 792 feet south of the center of sec. 18, T. 87 N., R. 6 W.

A1—0 to 18 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.
A2—18 to 38 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; common fine distinct dark brown (7.5YR 3/2) mottles; moderate fine subangular blocky structure; firm; neutral; clear smooth boundary.
Cg1—38 to 42 inches; gray (5Y 5/1) clay loam; few fine distinct olive brown (2.5Y 4/4) mottles; massive; firm; a few root channels with dark gray (10YR 4/1) coatings; neutral; clear smooth boundary.
Cg2—42 to 47 inches; very dark gray (5Y 3/1) clay loam; few fine distinct gray (5Y 5/1) mottles; massive; firm; few fine pebbles; neutral; clear smooth boundary.
Cg3—47 to 52 inches; gray (5Y 5/1) gravelly sandy loam; massive; friable; about 15 percent fine gravel; neutral; clear smooth boundary.
Cg4—52 to 60 inches; gray (5Y 5/1) gravelly sandy loam; massive; very friable; about 20 percent gravel; slightly acid.

The thickness of the solum ranges from 36 to 48 inches. The depth to free carbonates is commonly 60 inches or more, and the depth to pebbles is 40 inches or more.

The A horizon typically is black (10YR 2/1 or N 2/0) but in some pedons is very dark gray (10YR 3/1 or N 3/0). It is 36 or more inches thick. It typically is clay loam, but in some pedons the upper 10 inches is loam. The Cg horizon has hue of 5Y or is neutral in hue. It has value of 3 to 5 and chroma of 0 or 1. The upper part of this horizon typically is clay loam, but the range includes silty clay loam. The lower part is sandy loam or sand in which the content of gravel is 5 to 20 percent.

Colo Series

The Colo series consists of poorly drained, moderately permeable soils on bottom land and in upland drainageways. These soils formed in silty alluvium. The native vegetation was water-tolerant grasses. Slope ranges from 0 to 5 percent.

Colo soils are similar to Sawmill soils and are commonly adjacent to Downs, Ely, and Tama soils. The A horizon of Sawmill soils is thinner than that of the Colo soils. Downs and Tama soils are well drained and are in convex areas on ridges and side slopes. Downs soils do not have a mollic epipedon. Ely soils are somewhat poorly drained and are higher on the landscape than the Colo soils.

Typical pedon of Colo silt loam, in an area of Colo-Ely complex, 2 to 5 percent slopes; 1,320 feet east and 200 feet north of the center of sec. 5, T. 90 N., R. 3 W.

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam (25.8 percent clay), dark gray (10YR 4/1) dry; very dark gray (10YR 3/1) coatings on faces of peds; weak fine subangular blocky structure; friable; thin dark grayish brown (10YR 4/2) strata; neutral; clear smooth boundary.
A2—8 to 18 inches; black (10YR 2/1) silt loam (23.3 percent clay), very dark gray (10YR 3/1) dry; weak fine granular structure; friable; slightly acid; gradual smooth boundary.
A3—18 to 34 inches; black (N 2/0) silty clay loam (35.8 percent clay), black (10YR 2/1) dry; weak fine granular and moderate very fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.
A4—34 to 40 inches; very dark gray (10YR 3/1) silty clay loam (33.5 percent clay), dark gray (10YR 4/1) dry; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.
AC—40 to 47 inches; very dark gray (10YR 3/1) silty clay loam (28.9 percent clay), dark gray (10YR 4/1) dry; common fine distinct yellowish brown (10YR 5/6) mottles; weak fine prismatic structure; slightly acid; gradual smooth boundary.
Cg—47 to 60 inches; dark gray (10YR 4/1) silty clay loam (27.8 percent clay); common fine distinct light olive brown (2.5Y 5/6) and few medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; slightly acid.

The solum ranges from 36 to 54 inches in thickness. It is neutral or slightly acid throughout. Carbonates are not evident in the solum and generally are not evident within a depth of 60 inches.

Some pedons have 6 to 18 inches of stratified overwash. The overwash has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. It is slightly acid or neutral silt loam. The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1. The upper 18 inches of this horizon typically is silt loam, but the range includes silty clay loam. The content of clay in the part of the A horizon below a depth of 18 inches is 30 to 35 percent.

Cresken Series

The Cresken series consists of moderately well drained soils that formed in loamy sediments and in the underlying glacial till. These soils are on upland ridgetops and side slopes. Permeability is moderate in the upper part of the solum and is moderately slow in the lower part. The native vegetation was prairie grasses. Slope ranges from 2 to 5 percent.

Cresken soils are similar to Bassett, Kenyon, and Lourdes soils and are commonly adjacent to Kenyon, Lourdes, and Protivin soils. Bassett and Lourdes soils do not have a mollic epipedon. Bassett and Kenyon soils have less clay in the underlying glacial till than the

Cresken soils. Kenyon soils do not have gray coatings on the faces of peds. Protivin soils are somewhat poorly drained and are on concave side slopes. Kenyon and Lourdes soils are in landscape positions similar to those of the Cresken soils.

Typical pedon of Cresken clay loam, 2 to 5 percent slopes; 790 feet west and 685 feet south of the northeast corner of sec. 3, T. 87 N., R. 6 W.

Ap—0 to 7 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A1—7 to 12 inches; very dark brown (10YR 2/2) clay loam (30 percent clay), very dark gray (10YR 3/1) dry; continuous black (10YR 2/1) coatings on faces of peds; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A2—12 to 16 inches; dark brown (10YR 3/3) clay loam (30.5 percent clay), dark grayish brown (10YR 4/2) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

BA—16 to 20 inches; brown (10YR 4/3) clay loam (30.3 percent clay); discontinuous dark brown (10YR 3/3) coatings on faces of peds; weak fine subangular blocky structure; friable; a thin stone line consisting of rounded stones 1 to 3 inches in diameter; slightly acid; clear smooth boundary.

2Bw1—20 to 25 inches; yellowish brown (10YR 5/4) clay loam (31.7 percent clay); weak fine subangular blocky structure; firm; few pebbles; slightly acid; clear smooth boundary.

2Bw2—25 to 30 inches; yellowish brown (10YR 5/6) clay loam (30.3 percent clay); continuous grayish brown (2.5Y 5/2) silt coatings on faces of peds; few fine faint strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; very firm; few pebbles; few fine distinct yellowish red (5YR 5/8) concretions (iron oxide); medium acid; clear smooth boundary.

2Bw3—30 to 39 inches; strong brown (7.5YR 5/6) clay loam (30.0 percent clay); continuous grayish brown (2.5Y 5/2) silt coatings on faces of peds; moderate fine prismatic structure parting to moderate fine subangular blocky; very firm; few pebbles; few fine distinct yellowish red (5YR 5/8) concretions (iron oxide); medium acid; clear smooth boundary.

2BC—39 to 45 inches; mottled strong brown (7.5YR 5/6) and grayish brown (2.5Y 5/2) clay loam (27.3 percent clay); weak medium prismatic structure; very firm; few pebbles; discontinuous grayish brown (2.5Y 5/2) silt coatings on faces of peds; few fine distinct black (10YR 2/1) concretions (manganese oxide); slightly acid; clear smooth boundary.

2C1—45 to 55 inches; mottled strong brown (7.5YR 5/8) and gray (10YR 6/1) loam (24.9 percent clay); massive; very firm; few pebbles; few fine distinct dark reddish brown (5YR 2/2) and few medium distinct red (2.5YR 4/6) concretions (manganese and iron oxides); slightly acid; abrupt wavy boundary.

2C2—55 to 60 inches; mottled yellowish brown (10YR 5/4), yellowish brown (10YR 5/6), and grayish brown (2.5Y 5/2) loam (24.9 percent clay); massive; very firm; few pebbles; few fine distinct yellowish red (5YR 4/6) concretions (iron oxide); common fine soft lime accumulations; few thin soft lime threads; strong effervescence; mildly alkaline.

The solum typically is more than 40 inches thick. The depth to carbonates ranges from 40 to 65 inches. The depth to glacial till ranges from 12 to 25 inches. A stone line is commonly at the boundary between the loamy sediments and the glacial till.

The Ap or A1 horizon is black (10YR 2/1) or very dark brown (10YR 2/2). The AB or A2 horizon is dark brown (10YR 3/3) or very dark grayish brown (10YR 3/2). The 2B horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8. Below a depth of 25 inches, it has continuous grayish brown (2.5Y 5/2) silt coatings on the faces of peds. It typically is clay loam, but in some pedons the upper part is loam in which the content of clay is 25 to 30 percent.

Dickinson Series

The Dickinson series consists of somewhat excessively drained soils on upland ridgetops and side slopes and on alluvial terraces. These soils formed in eolian material more than 60 inches thick. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. The native vegetation was prairie grasses. Slope ranges from 0 to 9 percent.

Dickinson soils are similar to Bolan soils and are commonly adjacent to Olin, Schley, and Sparta soils. Bolan soils have less sand in the upper 20 to 30 inches than the Dickinson soils. Olin soils are underlain by glacial till at a depth of 20 to 36 inches. They are in landscape positions similar to those of the Dickinson soils. Schley soils are somewhat poorly drained and are in upland drainageways. Sparta soils have more sand in the A horizon and the upper part of the B horizon than the Dickinson soils. Also, they are on lower lying side slopes and interfluves.

Typical pedon of Dickinson fine sandy loam, 2 to 5 percent slopes; 1,500 feet east and 180 feet north of the center of sec. 26, T. 88 N., R. 6 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) fine sandy loam (60 percent sand), dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A1—7 to 14 inches; very dark brown (10YR 2/2) fine sandy loam (65 percent sand), dark grayish brown (10YR 4/2) dry; weak medium granular structure; friable; slightly acid; gradual smooth boundary.

A2—14 to 19 inches; very dark grayish brown (10YR 3/2) fine sandy loam (65 percent sand), grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; friable; medium acid; gradual smooth boundary.

BA—19 to 22 inches; dark brown (10YR 3/3) fine sandy loam (75 percent sand); weak medium subangular blocky structure; very friable; strongly acid; gradual smooth boundary.

Bw1—22 to 28 inches; dark yellowish brown (10YR 4/4) fine sandy loam (75 percent sand); weak medium subangular blocky structure; very friable; medium acid; gradual smooth boundary.

Bw2—28 to 33 inches; yellowish brown (10YR 5/4) loamy fine sand (80 percent sand); very weak medium subangular blocky structure; very friable; medium acid; gradual smooth boundary.

BC—33 to 40 inches; yellowish brown (10YR 5/4) loamy sand (80 percent sand); very weak coarse subangular blocky structure; very friable; medium acid; gradual smooth boundary.

C—40 to 60 inches; yellowish brown (10YR 5/6) loamy sand (85 percent sand); single grained; loose; brown (7.5YR 4/4) 1/2-inch iron bands at depths of 55 and 59 inches; strongly acid.

The solum ranges from 24 to 50 inches in thickness. The depth to loamy sand or sand is commonly 24 to 36 inches. The sand particles are dominantly fine and medium. The entire profile typically is free of gravel.

The A horizon commonly is very dark brown (10YR 2/2), but the range includes black (10YR 2/1) and very dark grayish brown (10YR 3/2). The BA horizon and the upper part of the Bw horizon generally are dark brown (10YR 3/3), brown (10YR 4/3), or dark yellowish brown (10YR 4/4), and the lower part of the Bw horizon is dark yellowish brown (10YR 4/4) or yellowish brown (10YR 5/6). In some pedons, however, the B horizon may have hue of 7.5YR. The Bw horizon is slightly acid to strongly acid. The C horizon ranges from sandy loam to sand.

Dinsdale Series

The Dinsdale series consists of well drained, moderately permeable soils on convex ridgetops and side slopes in the uplands. These soils formed in loess and in the underlying glacial till. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Dinsdale soils are similar to Tama and Waubeek soils and are commonly adjacent to Aredale, Sawmill, and Waubeek soils. Tama soils do not have loam in the subsoil or the substratum. Waubeek soils do not have a mollic epipedon. Aredale soils have sandy material in the substratum. Aredale and Waubeek soils are in landscape positions similar to those of the Dinsdale soils. Sawmill soils are poorly drained and are in upland drainageways.

Typical pedon of Dinsdale silt loam, 2 to 5 percent slopes; 925 feet east and 1,880 feet north of the southwest corner of sec. 28, T. 90 N., R. 4 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam (25 percent clay), very dark grayish brown (10YR 3/2) dry; black (10YR 2/1) discontinuous coatings on faces of peds; weak fine granular and subangular blocky structure; friable; neutral; abrupt smooth boundary.

A—7 to 13 inches; very dark grayish brown (10YR 3/2) silt loam (25 percent clay), dark grayish brown (10YR 4/2) dry; continuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky and granular structure; friable; medium acid; clear smooth boundary.

Bt1—13 to 20 inches; brown (10YR 4/3) silty clay loam (31 percent clay); discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; discontinuous clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—20 to 27 inches; dark yellowish brown (10YR 4/4) silty clay loam (31 percent clay); weak medium and fine subangular blocky structure; friable; discontinuous brown (10YR 4/3) clay films on faces of peds; medium acid; abrupt wavy boundary.

2Bt3—27 to 35 inches; yellowish brown (10YR 5/4 and 5/6) loam (29 percent clay); few fine faint yellowish brown (10YR 5/8) mottles; weak fine prismatic structure parting to weak medium subangular blocky; firm; discontinuous brown (10YR 4/3) clay films on faces of peds; a stone line with many 1- to 3-inch stones in the upper part; neutral; clear smooth boundary.

2BC—35 to 42 inches; yellowish brown (10YR 5/4 and 5/8) loam (24 percent clay); few fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure; firm; slightly acid; clear smooth boundary.

2C—42 to 60 inches; yellowish brown (10YR 5/4 and 5/8) loam (24 percent clay); few fine distinct grayish brown (10YR 5/2) mottles; massive; firm; neutral.

The thickness of the solum ranges from about 40 to 60 inches. The loess typically is 24 to 30 inches thick but ranges from 20 to 40 inches.

The Ap and A horizons are black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The surface soil is 10 to 20 inches thick. The upper part of the B horizon formed in loess. It is dark brown (10YR 3/3), brown (10YR 4/3), or dark yellowish brown (10YR 4/4). The content of clay in the upper part of the B horizon ranges from about 27 to 32 percent. The 2B and 2C horizons formed in glacial till. They have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. In most pedons they have mottles with value of 5 or 6 and chroma of 1 or 2. They typically are loam, but the range includes sandy clay loam and clay loam. In some pedons a stone line or a layer of sandy loam or loamy sand about 5 inches thick is between the loess and the glacial till.

Donnan Series

The Donnan series consists of moderately well drained and somewhat poorly drained soils on upland ridgetops. These soils formed in loamy sediments and in the underlying glacial till paleosol. Permeability is moderate in the upper part of the solum and very slow in the lower part. The native vegetation was prairie grasses and deciduous trees. Slope ranges from 2 to 6 percent.

Donnan soils are commonly adjacent to Cresken, Kenyon, and Protivin soils. Cresken and Kenyon soils are underlain by firm, loamy glacial till. They have a mollic epipedon. They are generally on the lower lying ridgetops and side slopes. Protivin soils are underlain by loamy glacial till that is browner than that of the Donnan soils. They are on concave side slopes.

Typical pedon of Donnan loam, 2 to 6 percent slopes; 1,584 feet west and 396 feet south of the northeast corner of sec. 2, T. 87 N., R. 6 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam (21 percent clay), grayish brown (10YR 5/2) dry; continuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

E—7 to 12 inches; brown (10YR 4/3) loam (21 percent clay), pale brown (10YR 6/3) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

BE—12 to 18 inches; yellowish brown (10YR 5/4) loam (21 percent clay); weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

Bw1—18 to 23 inches; yellowish brown (10YR 5/4) loam (21 percent clay); few fine distinct yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

Bw2—23 to 28 inches; mottled strong brown (7.5YR 5/6) and grayish brown (2.5Y 5/2) sandy loam (15 percent clay); few fine faint gray (5Y 6/1) mottles; weak fine subangular blocky structure; friable; few small pebbles; medium acid; abrupt smooth boundary.

2Bt1—28 to 45 inches; gray (5Y 5/1) clay (44 percent clay); common medium distinct light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; very firm; thick continuous light gray (10YR 7/1) dry silt coatings on faces of peds in the upper part; medium acid; gradual smooth boundary.

2Bt2—45 to 60 inches; dark gray (5Y 4/1) clay (42 percent clay); few medium distinct olive brown (2.5Y 4/4) mottles; moderate fine subangular blocky structure; very firm; neutral.

The solum ranges from 40 to 80 inches in thickness. It formed in loamy sediments 20 to 40 inches deep over the underlying paleosol. The sediments are loam or clay loam. The paleosol typically is clay, but the range includes silty clay. Typically, a sandy loam or loamy sand horizon 5 inches thick or less is between the loamy sediments and the clayey paleosol, but this horizon does not occur in some pedons. Reaction is medium acid or strongly acid in the most acid part of the solum.

The A or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 6 to 8 inches thick. The E horizon is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3). It is 2 to 5 inches thick. In some pedons it is completely incorporated into the Ap horizon. The upper part of the B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It commonly has mottles with chroma of 1 or 2. The 2B horizon has hue of 5Y or 2.5Y, value of 5 or 6, and chroma of 1 or 2. In some pedons the upper part of this horizon is mottled with strong brown (7.5YR 5/6 and 5/8) and grayish brown (10YR 5/2 and 2.5Y 5/2). It is silty clay loam or silt loam and is 8 to 18 inches thick. The 2B horizon has mottles with hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 8.

Dorchester Series

The Dorchester series consists of well drained, moderately permeable soils on bottom land. These soils formed in calcareous recent alluvium overlying an older buried soil. The native vegetation was grasses and scattered deciduous trees. Slope ranges from 0 to 2 percent.

Dorchester soils are commonly adjacent to Fayette and Nordness soils, which are on uplands. Fayette soils formed in silty loess and have a brown B horizon. Nordness soils formed in 8 to 20 inches of loess and in the underlying limestone bedrock residuum.

Typical pedon of Dorchester silt loam, 0 to 2 percent slopes; 1,035 feet north and 400 feet west of the southeast corner of sec. 2, T. 90 N., R. 3 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; slight effervescence; mildly alkaline; clear smooth boundary.

C1—5 to 21 inches; stratified dark grayish brown (10YR 4/2) and brown (10YR 5/3) silt loam, light brownish gray (10YR 6/2) dry; weak thin platy structure, resulting from stratification during deposition, parting to weak fine subangular blocky; friable; slight effervescence; mildly alkaline; gradual smooth boundary.

C2—21 to 42 inches; stratified dark grayish brown (10YR 4/2) and brown (10YR 5/3) silt loam; common fine distinct brown (7.5YR 4/4) mottles; weak thick platy structure resulting from stratification during deposition; friable; slight effervescence; mildly alkaline; abrupt wavy boundary.

2Ab—42 to 60 inches; very dark brown (10YR 2/2) silt loam; weak fine subangular blocky structure; friable; slight effervescence; mildly alkaline.

The stratified sediments have been altered little by soil-forming factors since deposition. The thickness of the solum is less than 10 inches and corresponds to the thickness of the A or Ap horizon. The depth to the 2Ab horizon ranges from 30 to 60 inches. Some pedons do not have this horizon.

The C horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. It typically has thin strata of very dark gray (10YR 3/1), light brownish gray (10YR 6/2), and pale brown (10YR 6/3). In the lower part it typically has mottles with hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is dominantly silt loam, but in some pedons it has thin strata of loam to sandy loam. It is mildly alkaline or moderately alkaline. The 2Ab horizon has hue of 10YR, value of 2, and chroma of 1 or 2. It typically is silt loam, but in some pedons it is silty clay loam or clay loam in which the content of clay is 27 to 30 percent.

Downs Series

The Downs series consists of well drained, moderately permeable soils that formed in loess on upland ridgetops and side slopes. The native vegetation was mixed prairie grasses and deciduous trees. Slope ranges from 2 to 14 percent.

Downs soils are similar to Fayette, Tama, and Waubeek soils and are commonly adjacent to Colo, Fayette, Newvienna, and Waubeek soils. Fayette soils have a surface layer that is thinner and lighter colored than that of Downs soils and have a more distinct E horizon. They are on the lower, steeper parts of the landscape. Tama and Waubeek soils are in landscape positions similar to those of the Downs soils. Tama soils have a mollic epipedon. Waubeek soils have loam glacial till in the part of the substratum within a depth of 40 inches. Colo soils are poorly drained and are in upland drainageways and on bottom land. Newvienna soils have a water table at a depth of 3 to 5 feet during some parts of the year. They are on side slopes below the Downs soils.

Typical pedon of Downs silt loam, 5 to 9 percent slopes; 1,715 feet west and 825 feet south of the northeast corner of sec. 24, T. 90 N., R. 3 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam (21 percent clay), grayish brown (10YR 5/2) dry; discontinuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky and granular structure; friable; neutral; abrupt smooth boundary.

E—8 to 14 inches; dark grayish brown (10YR 4/2) silt loam (18 percent clay), light brownish gray (10YR 6/2) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy and weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

BE—14 to 18 inches; brown (10YR 4/3) silt loam (21 percent clay); discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

Bt1—18 to 25 inches; dark yellowish brown (10YR 4/4) silty clay loam (29 percent clay); moderate fine subangular blocky structure; friable; thin discontinuous dark brown (7.5YR 3/4) clay films on faces of peds; discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

Bt2—25 to 35 inches; yellowish brown (10YR 5/4) silty clay loam (29 percent clay); moderate fine subangular blocky and angular blocky structure; friable; thin discontinuous dark brown (7.5YR 3/4) clay films on faces of peds; discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

Bt3—35 to 44 inches; yellowish brown (10YR 5/4) silty clay loam (29 percent clay); moderate medium prismatic structure; friable; thin discontinuous dark brown (7.5YR 3/4) clay films on faces of peds; discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; few fine black (10YR 2/1) concretions (manganese oxide); medium acid; gradual smooth boundary.

C—44 to 60 inches; yellowish brown (10YR 5/4) silt loam (25 percent clay); few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; friable; common fine black (10YR 2/1) concretions (manganese oxide); few black (10YR 2/1) organic stains in root channels; medium acid.

The solum ranges from 42 to more than 60 inches in thickness. The A or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 6 to 9 inches thick. The E horizon is dark grayish brown (10YR 4/2) or dark brown or brown (10YR 4/3). It is 2 to 6 inches thick. In some pedons it is completely incorporated into the Ap horizon. The Bt horizon is brown (10YR 4/3), dark yellowish brown (10YR 4/4), or yellowish brown (10YR 5/4). The content of clay in this horizon ranges from 25 to 33 percent. The B horizon is medium acid to very strongly acid.

Dubuque Series

The Dubuque series consists of moderately deep, well drained soils on uplands. These soils formed in loess and in the underlying clayey material weathered from limestone bedrock. Permeability is moderate in the upper part of the solum and slow in the lower part. The native vegetation was deciduous trees. Slope ranges from 5 to 18 percent.

Dubuque soils are commonly adjacent to Exette, Fayette, and Nordness soils. Fayette and Exette soils are not underlain by limestone bedrock within a depth of 48 inches. They are higher on the landscape than the Dubuque soils. Nordness soils have limestone bedrock at a depth of 8 to 20 inches. They are in landscape positions similar to those of the Dubuque soils.

Typical pedon of Dubuque silt loam, 20 to 30 inches to limestone, 5 to 9 percent slopes; 1,915 feet north and 700 feet west of the southeast corner of sec. 36, T. 88 N., R. 4 W.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam (21 percent clay), grayish brown (10YR 5/2) dry; continuous very dark gray (10YR 3/1) coatings on faces of peds; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

E—3 to 8 inches; dark grayish brown (10YR 4/2) silt loam (18 percent clay), pale brown (10YR 6/3) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure; friable; slightly acid; clear smooth boundary.

BE—8 to 12 inches; brown (10YR 4/3) silt loam (21 percent clay); discontinuous dark grayish brown (10YR 4/2) coatings on faces of peds; weak and moderate fine subangular blocky structure; friable; discontinuous light gray (10YR 7/1) dry silt coatings; strongly acid; clear smooth boundary.

Bt1—12 to 23 inches; yellowish brown (10YR 5/4) silty clay loam (29 percent clay); continuous brown (10YR 4/3) coatings on faces of peds; strong medium and fine angular blocky structure; friable; discontinuous light gray (10YR 7/1) dry silt coatings; strongly acid; clear smooth boundary.

2Bt2—23 to 28 inches; brown (7.5YR 4/4) clay (44 percent clay); discontinuous dark brown (7.5YR 3/2) coatings on faces of peds; strong medium angular blocky structure; firm; continuous brown (7.5YR 4/4) clay films; medium acid; abrupt smooth boundary.

2R—28 inches; hard fractured limestone bedrock.

The depth to limestone residuum ranges from 20 to 30 inches. Reaction is medium acid or strongly acid in the most acid part of the solum.

The A horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 2 to 4 inches thick. The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3 or 5/3). The E horizon typically is dark grayish brown (10YR 4/2) but in some pedons is grayish brown (10YR 5/2) or brown (10YR 5/3). It typically is 4 to 8 inches thick. In some cultivated areas it is incorporated into the Ap horizon. The 2Bt horizon is silty clay or clay. It is 1 to 5 inches thick.

Ely Series

The Ely series consists of somewhat poorly drained, moderately permeable soils in upland drainageways and on foot slopes. These soils formed in silty alluvium. The native vegetation was prairie grasses. Slope ranges from 2 to 5 percent.

Ely soils are similar to Worthen soils and are commonly adjacent to Colo, Downs, Ossian, and Tama soils. Worthen soils are well drained. Colo soils are poorly drained and are lower on the landscape than the Ely soils. Downs and Tama soils are well drained and are in convex areas on ridges and side slopes. Downs soils do not have a mollic epipedon, and Tama soils do not have a cumulic A horizon. Ossian soils are poorly drained and are on bottom land.

Typical pedon of Ely silty clay loam, in an area of Colo-Ely complex, 2 to 5 percent slopes; 1,190 feet east and 400 feet north of the center of sec. 5, T. 90 N., R. 3 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam (27.5 percent clay), very dark gray (10YR 3/1) dry; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

A—8 to 20 inches; black (10YR 2/1) silty clay loam (29.2 percent clay), very dark gray (10YR 3/1) dry; weak fine subangular blocky and granular structure; friable; medium acid; gradual smooth boundary.

AB—20 to 26 inches; very dark grayish brown (10YR 3/2) silty clay loam (27.6 percent clay), dark grayish brown (10YR 4/2) dry; discontinuous black (10YR 2/1) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

Bw1—26 to 33 inches; dark grayish brown (2.5Y 4/2) silty clay loam (30.8 percent clay); few fine faint light olive brown (2.5Y 5/4) mottles; weak fine subangular blocky structure; friable; discontinuous light gray (10YR 7/1) silt coatings on faces of peds; slightly acid; gradual smooth boundary.

Bw2—33 to 41 inches; grayish brown (2.5Y 5/2) silty clay loam (30.7 percent clay); few fine distinct yellowish brown (10YR 5/6) mottles; weak fine prismatic structure parting to weak fine subangular blocky; friable; slightly acid; clear smooth boundary.

BC—41 to 49 inches; grayish brown (2.5Y 5/2) silty clay loam (33.6 percent clay); common medium distinct strong brown (7.5YR 5/6) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; friable; few yellowish red (5YR 4/6) concretions (iron oxide); slightly acid; clear smooth boundary.

C—49 to 60 inches; mottled grayish brown (2.5Y 5/2), light olive brown (2.5Y 5/4), and strong brown (7.5YR 5/6) silt loam (26.7 percent clay); massive; friable; common dark gray (10YR 4/1) clay flows in root channels; black (10YR 2/1) and yellowish red (5YR 4/6) concretions (manganese and iron oxides); slightly acid.

The solum is commonly more than 48 inches thick but ranges from 40 to 66 inches. Stratification is evident in the upper 6 to 15 inches of some pedons because of recent overwash.

The A horizon typically is black (10YR 2/1), but the range includes very dark brown (10YR 2/2), very dark gray (10YR 3/1), and very dark grayish brown (10YR 3/2). This horizon typically is silty clay loam, but the range includes silt loam. The Bw horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2 to 4. It is silty clay loam in which the content of clay is 28 to 35 percent. The C horizon typically has a mottled matrix with hue of 2.5Y to 7.5YR, value of 4 or 5, and chroma of 2 to 6. It is silty clay loam, silt loam, or loam.

Exette Series

The Exette series consists of well drained, moderately permeable soils on side slopes and at the head of drainageways on loess-covered uplands. These soils formed in loess. The native vegetation was deciduous trees. Slope ranges from 14 to 25 percent.

Exette soils are commonly adjacent to Dubuque, Fayette, and Lindley soils. The adjacent soils are in landscape positions similar to those of the Exette soils. Dubuque soils have limestone bedrock at a depth of 20 to 30 inches. Fayette soils are browner in the B and C horizons than the Exette soils and have more clay in the B horizon. Lindley soils formed in loamy glacial till.

Typical pedon of Exette silt loam, 14 to 18 percent slopes, moderately eroded; 660 feet north and 265 feet west of the southeast corner of sec. 10, T. 90 N., R. 6 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam (21 percent clay), pale brown (10YR 6/3) dry; mixed with streaks and pockets of yellowish brown (10YR 5/4) silt loam subsoil material; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

Bw1—8 to 17 inches; yellowish brown (10YR 5/4) silt loam (20 percent clay); discontinuous brown (10YR 4/3) coatings on faces of peds; few fine distinct strong brown (7.5YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; thin discontinuous light gray (10YR 7/1) dry silt coatings; medium acid; gradual smooth boundary.

Bw2—17 to 24 inches; mottled yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) silt loam (18 percent clay); discontinuous dark yellowish brown (10YR 4/4) coatings on faces of peds; weak medium subangular blocky structure; friable; thin discontinuous light gray (10YR 7/1) dry silt coatings; few black (10YR 2/1) concretions (manganese oxide); medium acid; gradual smooth boundary.

BC—24 to 32 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) silt loam (18 percent clay); common fine distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; common black (10YR 2/1) concretions (manganese oxide); large yellowish red (5YR 5/6) iron accumulations; medium acid; gradual smooth boundary.

C—32 to 60 inches; mottled light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/8) silt loam (18 percent clay); massive; friable; few fine dark red (2.5YR 3/6) and dark reddish brown (5YR 2/2) concretions (manganese and iron oxides); slightly acid.

The thickness of the solum ranges from 30 to 45 inches. Reaction is neutral to medium acid in the most acid part of the profile.

The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3). The Bw and BC horizons have hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 4. Mottles are within a depth of 30 inches. They have hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 8. The percentage of mottles with chroma of 2 is at least 20 percent within a depth of 30 inches. The maximum clay content is near the surface. The clay content in the Ap and BE horizons ranges from 18 to 26 percent. That of the Bw, BC, and C horizons ranges from 15 to 20 percent.

Fayette Series

The Fayette series consists of well drained, moderately permeable soils on upland ridgetops and side slopes. These soils formed in loess. The native vegetation was deciduous trees. Slope ranges from 2 to 40 percent.

Fayette soils are similar to Downs and Seaton soils and are commonly adjacent to Dorchester, Downs, Dubuque, and Nordness soils. The surface layer of Downs soils is darker and thicker than that of the Fayette soils, and the E horizon is less distinct. Seaton soils have a subsoil of silt loam. Their ratio of coarse silt to fine silt is higher than that of the Fayette soils.

Dorchester soils formed in stratified, silty alluvium on bottom land. Dubuque and Nordness soils are lower on the landscape than the Fayette soils. Dubuque soils are moderately deep over limestone bedrock, and Nordness soils are shallow over limestone bedrock.

Typical pedon of Fayette silt loam, 9 to 14 percent slopes; 890 feet west and 140 feet south of the northeast corner of sec. 14, T. 90 N., R. 3 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam (15 percent clay), grayish brown (10YR 5/2) dry; discontinuous very dark gray (10YR 3/1) coatings on faces of peds; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

E—4 to 12 inches; brown (10YR 5/3) silt loam (15 percent clay), very pale brown (10YR 7/3) dry; weak thin platy structure; friable; medium acid; clear smooth boundary.

BE—12 to 16 inches; dark yellowish brown (10YR 4/4) silt loam (21 percent clay); weak medium subangular blocky structure; friable; medium acid; clear smooth boundary.

Bt1—16 to 21 inches; dark yellowish brown (10YR 4/4) silty clay loam (29 percent clay); moderate medium angular blocky structure; friable; discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid; clear smooth boundary.

Bt2—21 to 29 inches; yellowish brown (10YR 5/4) silty clay loam (29 percent clay); continuous dark yellowish brown (10YR 4/4) coatings on faces of peds; strong medium angular blocky structure; friable; nearly continuous light gray (10YR 7/1) dry silt coatings on faces of peds; discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt3—29 to 38 inches; yellowish brown (10YR 5/4) silty clay loam (29 percent clay); continuous dark yellowish brown (10YR 4/4) coatings on faces of peds; moderate medium angular blocky structure; friable; discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt4—38 to 46 inches; yellowish brown (10YR 5/4) silty clay loam (29 percent clay); weak fine prismatic structure parting to weak medium subangular blocky; friable; nearly continuous light gray (10YR 7/1) dry silt coatings on faces of peds; discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; medium acid; gradual smooth boundary.

C—46 to 60 inches; yellowish brown (10YR 5/4) silt loam (25 percent clay); few fine faint grayish brown (10YR 5/2) mottles; massive; friable; few fine black (10YR 2/1) concretions (manganese oxide); medium acid.

The solum typically is 42 to 50 inches thick but ranges from 36 to 60 inches. It is very strongly acid or strongly acid in the most acid part.

The A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 2 to 5 inches thick. The Ap horizon typically is dark grayish brown (10YR 4/2) but in some pedons is brown (10YR 4/3). The E horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or brown (10YR 5/3). In some pedons it is incorporated into the Ap horizon. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam in which the clay content is 27 to 32 percent. Mottles that have hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2 are commonly in the lower part of the B horizon and in the C horizon. The depth to the mottles generally decreases as slope increases.

Finchford Series

The Finchford series consists of excessively drained, very rapidly permeable soils on alluvial terraces and terrace escarpments. These soils formed in alluvium of coarse sand and gravel. The native vegetation was drought-tolerant grasses. Slope ranges from 0 to 9 percent.

Finchford soils are commonly adjacent to Flagler, Lilah, and Saude soils. The adjacent soils are in landscape positions similar to those of the Finchford soils. Flagler and Lilah soils formed in moderately coarse textured material over sand and gravel. Saude soils formed in loamy material over sand and gravel.

Typical pedon of Finchford loamy sand, 0 to 2 percent slopes; 925 feet south and 1,190 feet east of the center of sec. 10, T. 88 N., R. 5 W.

A—0 to 10 inches; dark brown (10YR 3/3) loamy sand, brown (10YR 5/3) dry; weak fine subangular blocky structure; very friable; less than 5 percent gravel and some chert; neutral; abrupt smooth boundary.

BA—10 to 14 inches; brown (7.5YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; about 5 percent gravel; slightly acid; clear smooth boundary.

Bw—14 to 29 inches; strong brown (7.5YR 5/6) and dark brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; 10 to 15 percent gravel and some chert; medium acid; clear smooth boundary.

C—29 to 60 inches; brown (7.5YR 4/4) and strong brown (7.5YR 5/6) gravelly loamy sand; single grained; loose; iron bands about 1 inch thick between depths of 50 and 60 inches; 30 to 40 percent gravel and common chert fragments; medium acid.

The solum ranges from 24 to 36 inches in thickness. It is loamy sand to sand.

The A horizon is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3). The B horizon has hue of 10YR or 7.5YR, value of 3 or more, and chroma of 2 or more. It is slightly acid to strongly acid. The C horizon has hue of 7.5YR or 10YR and value and chroma of 4 or more.

Flagler Series

The Flagler series consists of somewhat excessively drained soils on alluvial terraces. These soils formed in loamy material underlain by sand and gravel. Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Flagler soils are similar to Saude soils and are commonly adjacent to Burkhardt, Saude, and Wapsie soils. The adjacent soils are in positions on the landscape similar to those of the Flagler soils. Burkhardt soils are shallower to sand and gravel than the Flagler soils. Saude and Wapsie soils have less sand in the upper 24 to 32 inches of the solum than the Flagler soils. Wapsie soils do not have a mollic epipedon.

Typical pedon of Flagler fine sandy loam, 0 to 2 percent slopes; 765 feet west and 265 feet south of the center of sec. 17, T. 87 N., R. 6 W.

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

A2—10 to 16 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; discontinuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular structure; very friable; medium acid; clear smooth boundary.

AB—16 to 20 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; slightly acid; clear smooth boundary.

Bw—20 to 30 inches; brown (10YR 4/3) sandy loam; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; very friable; slightly acid; abrupt wavy boundary.

BC—30 to 36 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam (estimated 25 percent gravel); weak medium subangular blocky structure; very friable; medium acid; clear smooth boundary.

2C—36 to 60 inches; yellowish brown (10YR 5/6) coarse sand (estimated 15 percent gravel); single grained; loose; brownish yellow (10YR 6/6) very fine sand strata at depths of 39 and 42 inches; strongly acid.

The thickness of the solum typically is 24 to 40 inches but ranges from 20 to 50 inches. The depth to loamy sand, gravelly sand, or sand ranges from 20 to 36 inches.

The A1 or Ap horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). The A horizon ranges from 12 to 24 inches in thickness. The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The content of clay in this horizon ranges from 10 to 18 percent, and content of sand ranges from 60 to 70 percent. The 2C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is gravelly sand, gravelly loamy sand, or coarse sand. The content of gravel in this horizon is, by volume, 5 to 15 percent. The B horizon is slightly acid or medium acid, and the 2C horizon is medium acid or strongly acid.

Floyd Series

The Floyd series consists of somewhat poorly drained, moderately permeable soils in upland drainageways. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation was prairie grasses. Slope ranges from 1 to 4 percent.

Floyd soils are similar to Clyde and Schley soils and are commonly adjacent to Bolan, Clyde, Kenyon, Oran, Readlyn, and Schley soils. Clyde soils are poorly drained and are closer to drainageways than the Floyd soils. Schley soils do not have a mollic epipedon. They are in positions on the landscape similar to those of the Floyd soils. Bolan and Kenyon soils are on convex ridgetops and side slopes. Bolan soils have more sand throughout the solum than the Floyd soils. They are well drained. Kenyon soils are moderately well drained. Oran soils do not have a mollic epipedon. Oran and Readlyn soils formed in 14 to 26 inches of loamy sediments and in the underlying glacial till. They are very gently sloping and are on ridgetops.

Typical pedon of Floyd loam, in an area of Clyde-Floyd complex, 1 to 4 percent slopes; 264 feet north and 132 feet east of the southwest corner of sec. 18, T. 87 N., R. 6 W.

A1—0 to 12 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; gradual smooth boundary.

A2—12 to 22 inches; very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure; friable; neutral; gradual smooth boundary.

BA—22 to 30 inches; dark grayish brown (2.5Y 4/2) loam, very dark grayish brown (2.5Y 3/2) kneaded; nearly continuous very dark gray (10YR 3/1) coatings on faces of peds; common fine distinct olive brown (2.5Y 4/4) mottles; moderate medium and fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bw1—30 to 36 inches; olive brown (2.5Y 4/4) sandy loam; few medium faint dark grayish brown (2.5Y

4/2) mottles; weak medium subangular blocky structure; friable; few dark oxides; thin discontinuous dark grayish brown (2.5Y 4/2) coatings on faces of peds; thin stone line at a depth of 36 inches; about 5 percent fine gravel; neutral; abrupt wavy boundary.

2Bw2—36 to 43 inches; light olive brown (2.5Y 5/4) loam; common fine distinct grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine pebbles; nearly continuous grayish brown (2.5Y 5/2) coatings on faces of prisms; few fine dark oxides; neutral; clear smooth boundary.

2Bw3—43 to 48 inches; light olive brown (2.5Y 5/6) loam; common fine distinct grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/8) mottles; moderate coarse prismatic structure parting to moderate fine subangular blocky; firm; discontinuous grayish brown (2.5Y 5/2) coatings on faces of peds; few fine dark oxides; neutral; clear smooth boundary.

2BC—48 to 57 inches; grayish brown (2.5Y 5/2) loam; common fine distinct light olive brown (2.5Y 5/4 and 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; continuous dark gray (10YR 4/1) coatings in root channels; neutral; gradual smooth boundary.

2C—57 to 60 inches; grayish brown (2.5Y 5/2) loam; common fine distinct light olive brown (2.5Y 5/6) mottles; massive; firm; dark gray (10YR 4/1) coatings in root channels; neutral.

The solum commonly ranges from 40 to 60 inches in thickness. The depth to glacial till ranges from 30 to 45 inches. Typically, a thin stone line is at the boundary between the loamy sediments and the glacial till. The depth to carbonates ranges from 45 to 75 inches.

The A1 horizon typically is black (10YR 2/1 or N 2/0), but the range includes very dark brown (10YR 2/2). The A horizon typically is loam but is silt loam, clay loam, or silty clay loam in some pedons. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. It typically is loam and sandy loam, but the range includes clay loam. The 2B horizon typically is loam, but the range includes clay loam and sandy clay loam.

Goss Series

The Goss series consists of well drained and somewhat excessively drained, moderately permeable soils on upland ridges and side slopes. These soils formed in 8 to 20 inches of loamy sediments and in the underlying material weathered from cherty limestone. The native vegetation was deciduous trees. Slope ranges from 2 to 9 percent.

Goss soils are commonly adjacent to Backbone, Chelsea, Nordness, and Whalan soils. Backbone, Nordness, and Whalan soils have less than 6 inches of material weathered from limestone. Chelsea soils formed in sandy eolian material. Backbone and Chelsea soils are in landscape positions similar to those of the Goss soils. Nordness soils are on upland side slopes. Whalan soils are on upland ridgetops.

Typical pedon of Goss loam, 2 to 9 percent slopes; 265 feet west and 400 feet south of the northeast corner of sec. 3, T. 90 N., R. 6 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

E—4 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure; friable; slightly acid; clear smooth boundary.

BE—10 to 18 inches; brown (10YR 4/3) loam; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate medium and fine angular blocky structure and subangular blocky structure; friable; few fine chert fragments; slightly acid; abrupt wavy boundary.

2Bt1—18 to 36 inches; dark red (10R 3/6) very cherty clay; strong fine angular blocky structure; very firm; pinkish gray (5YR 6/2) streaks 1 to 2 inches thick at a depth of 22 to 24 inches; 40 to 50 percent chert fragments 5 to 60 millimeters in diameter; thick nearly continuous clay films on faces of peds; nearly continuous clay rinds on chert fragments; strongly acid; gradual smooth boundary.

2Bt2—36 to 60 inches; red (10R 4/6) extremely cherty clay; common fine distinct reddish yellow (7.5YR 6/8) mottles; strong very fine angular blocky structure; very firm; thick nearly continuous clay films on faces of peds; nearly continuous clay rinds on chert fragments; 70 to 80 percent chert fragments 5 to 60 millimeters in diameter; very strongly acid.

The solum ranges from 60 to 80 inches in thickness. It is strongly acid or very strongly acid in the most acid part.

The A horizon typically is loam, but the range includes silt loam in which the content of sand is 10 to 20 percent. It also includes sandy loam. The 2Bt horizon has hue of 10R to 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is very cherty or extremely cherty clay or very cherty or extremely cherty silty clay. The content of chert fragments in this horizon ranges from 40 to 80 percent.

Hayfield Series

The Hayfield series consists of somewhat poorly drained soils on alluvial terraces. These soils formed in loamy material underlain by sand and gravel. Permeability is moderate in the solum and rapid in the substratum. The native vegetation was prairie grasses and deciduous trees. Slope ranges from 0 to 2 percent.

Hayfield soils are similar to Lawler soils and are commonly adjacent to Lawler, Marshan, Spillville, and Wapsie soils. The A horizon of Lawler and Spillville soils is thicker than that of the Hayfield soils. Spillville soils are underlain by coarse textured material at a depth of more than 40 inches. Marshan soils are poorly drained. Their B horizon is grayer than that of the Hayfield soils. Wapsie soils are well drained. Lawler, Marshan, and Wapsie soils are in landscape positions similar to those of the Hayfield soils. Spillville soils are on bottom land.

Typical pedon of Hayfield loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes; 1,160 feet west and 800 feet south of the northeast corner of sec. 8, T. 88 N., R. 5 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; discontinuous very dark gray (10YR 3/1) coatings on faces of peds; weak fine granular structure; friable; neutral; abrupt smooth boundary.

E—8 to 12 inches; dark grayish brown (10YR 4/2) loam, light gray (10YR 7/2) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; few fine distinct strong brown (7.5YR 4/6) mottles; weak thin platy structure; friable; black (10YR 2/1) oxides; strongly acid; clear smooth boundary.

Bt1—12 to 20 inches; brown (10YR 5/3) loam; common fine distinct strong brown (7.5YR 5/8) mottles; medium fine subangular blocky structure; friable; very dark grayish brown (10YR 3/2) clay films; black (10YR 2/1) oxides; medium acid; clear smooth boundary.

Bt2—20 to 27 inches; grayish brown (10YR 5/2) clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; dark brown (7.5YR 3/2) clay films in root pores; light gray (10YR 7/1) dry silt coatings on faces of peds; black (10YR 2/1) oxides; strongly acid; clear smooth boundary.

Bt3—27 to 31 inches; grayish brown (10YR 5/2) clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; light gray (10YR 7/1) dry silt coatings on faces of peds; black (10YR 2/1) oxides; medium acid; abrupt wavy boundary.

2C—31 to 60 inches; light brownish gray (10YR 6/2) stratified loamy sand and gravel; common fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; few fine distinct yellowish red (5YR 4/6) oxides; medium acid.

The depth to coarse textured material typically is 24 to 32 inches, but in some pedons it ranges to 40 inches. It generally is the same as the thickness of the solum.

The A or Ap horizon is loam or silt loam. It has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). It typically has dark brown (7.5YR 4/4) or strong brown (7.5YR 4/6) mottles. The Bt horizon is clay loam or loam. It has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It has mottles with hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 8. The 2C horizon is loamy sand and gravel, gravelly loamy sand, or sand.

Kenyon Series

The Kenyon series consists of moderately well drained, moderately permeable soils that formed in 12 to 26 inches of friable, loamy sediments and in the underlying firm glacial till. These soils are on convex ridgetops and side slopes in the uplands. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Kenyon soils are similar to Bassett, Cresken, and Olin soils and are commonly adjacent to Cresken, Clyde, Donnan, Floyd, Olin, and Readlyn soils. Bassett soils do not have a mollic epipedon. Cresken soils have more clay in the underlying glacial till than the Kenyon soils. Olin soils have more sand in the upper part than the Kenyon soils. The poorly drained Clyde and somewhat poorly drained Floyd soils are in upland drainageways. Donnan soils have a gray paleosol underlying the loamy sediments. They are on convex ridgetops, generally at the highest point on the landscape. The somewhat poorly drained Readlyn soils are on plane or slightly concave ridgetops.

Typical pedon of Kenyon loam, 2 to 5 percent slopes; 1,386 feet east and 462 feet north of the center of sec. 6, T. 87 N., R. 6 W.

Ap—0 to 7 inches; black (10YR 2/1) loam (21 percent clay), dark grayish brown (10YR 4/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular structure; friable; medium acid; clear smooth boundary.

A—7 to 13 inches; black (10YR 2/1) loam (21 percent clay), dark grayish brown (10YR 4/2) dry; continuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular structure; friable; medium acid; clear smooth boundary.

AB—13 to 17 inches; very dark grayish brown (10YR 3/2) loam (21 percent clay), dark grayish brown (10YR 4/2) dry; discontinuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure; friable; mixed with a small amount of dark brown (10YR 3/3) material in the lower part; medium acid; clear smooth boundary.

Bw1—17 to 21 inches; brown (10YR 4/3) loam (24 percent clay); continuous very dark grayish brown (10YR 3/2) and discontinuous very dark brown

(10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure; friable; stone line at a depth of 20 to 21 inches; medium acid; clear smooth boundary.

2Bw2—21 to 28 inches; dark yellowish brown (10YR 4/4) loam (24 percent clay); discontinuous brown (10YR 4/3) coatings on faces of peds; weak fine subangular blocky structure; firm; few fine distinct black (10YR 2/1) and few medium distinct strong brown (7.5YR 5/6) concretions (manganese oxide); medium acid; clear smooth boundary.

2Bw3—28 to 37 inches; yellowish brown (10YR 5/6) loam (24 percent clay); discontinuous dark yellowish brown (10YR 4/4) coatings on faces of peds; few fine distinct brown (10YR 5/3) mottles; weak fine subangular blocky structure; firm; few fine distinct black (10YR 2/1) concretions (manganese oxide); medium acid; clear smooth boundary.

2Bw4—37 to 45 inches; yellowish brown (10YR 5/6) loam (24 percent clay); discontinuous brown (10YR 5/3) and gray (10YR 6/1) coatings on faces of peds; common fine faint grayish brown (10YR 5/2) and common fine distinct strong brown (7.5YR 5/8) mottles; weak fine prismatic structure parting to weak fine subangular blocky; firm; few fine distinct black (10YR 2/1) concretions (manganese oxide); medium acid; clear smooth boundary.

2BC—45 to 54 inches; mottled yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) loam (21 percent clay); discontinuous brown (10YR 5/3) coatings on faces of peds; few fine distinct strong brown (7.5YR 5/8) mottles; weak medium prismatic structure; firm; few fine distinct black (10YR 2/1) concretions (manganese oxide); slightly acid; clear smooth boundary.

2C—54 to 60 inches; mottled yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) loam (21 percent clay); massive; firm; few fine black (10YR 2/1) and few medium yellowish red (5YR 5/8) concretions (manganese and iron oxides); neutral.

The thickness of the solum ranges from 45 to 66 inches. The upper sediments are loam, and the glacial till is loam, sandy clay loam, or clay loam.

The A horizon typically is black (10YR 2/1) or very dark brown (10YR 2/2), but the range includes very dark grayish brown (10YR 3/2). The thickness of the A horizon combined with that of the AB horizon ranges from 10 to 20 inches. Most pedons have a brown (10YR 4/3) or dark brown (10YR 3/3) BA horizon. The Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. Typically, a stone line separates the loamy upper sediments from the firm glacial till. The 2Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It has mottles with chroma of 1 or 2 below a depth of 30 inches. It is slightly acid or medium acid in the most acid part. The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 6.

Lamont Series

The Lamont series consists of well drained, moderately rapidly permeable soils in convex areas on upland ridges and side slopes and on knolls on alluvial terraces. These soils formed in moderately coarse textured and coarse textured eolian sediments. The native vegetation was deciduous trees. Slope ranges from 2 to 9 percent.

Lamont soils are commonly adjacent to Backbone, Chelsea, Fayette, and Seaton soils on uplands and to Lilah soils on terraces. Backbone soils have limestone bedrock at a depth of 20 to 40 inches. Chelsea soils typically have a loamy fine sand A horizon. Fayette soils are silt loam and silty clay loam throughout. Seaton soils are silt loam throughout. Lilah soils have gravel within a depth of 40 inches.

Typical pedon of Lamont fine sandy loam, 2 to 5 percent slopes; 955 feet south and 395 feet west of the center of sec. 23, T. 90 N., R. 6 W.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) fine sandy loam (10 percent clay), grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

E—5 to 11 inches; brown (10YR 4/3) and dark grayish brown (10YR 4/2) fine sandy loam (9 percent clay), pale brown (10YR 6/3) and light brownish gray (10YR 6/2) dry; weak thin platy and weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

BE—11 to 15 inches; brown (7.5YR 4/4) fine sandy loam (11 percent clay); discontinuous brown (10YR 4/3) coatings on faces of peds; weak medium subangular blocky structure; friable; strongly acid; gradual smooth boundary.

Bt1—15 to 23 inches; brown (7.5YR 4/4) fine sandy loam (15 percent clay); weak medium subangular blocky structure; friable; discontinuous dark brown (7.5YR 3/2) clay bridges between sand grains; strongly acid; gradual smooth boundary.

Bt2—23 to 31 inches; strong brown (7.5YR 5/6) fine sandy loam (15 percent clay); weak medium subangular blocky structure; very friable; few brown (7.5YR 4/4) clay bridges between sand grains; medium acid; gradual smooth boundary.

E'—31 to 52 inches; brownish yellow (10YR 6/6) loamy fine sand (12 percent clay); few fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; medium acid; abrupt wavy boundary.

E&Bt—52 to 60 inches; light yellowish brown (10YR 6/4) loamy fine sand (E); single grained; loose; few strong brown (7.5YR 5/6) fine sandy loam (Bt) lamellae 1/2 inch to 2 inches thick; medium acid.

The thickness of the solum ranges from 30 to more than 60 inches.

The A or Ap horizon is very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), or very dark gray (10YR 3/1). In uneroded areas the E horizon is dark grayish brown (10YR 4/2), brown (10YR 4/3), or grayish brown (10YR 5/2). In some cultivated areas it is incorporated into the Ap horizon. The Bt horizon is fine sandy loam, loam, or sandy clay loam. It has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The E' horizon typically is brownish yellow (10YR 6/6), but the range includes yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6). The E' horizon and the E part of the E&Bt horizon typically are loamy fine sand, but the range includes sand.

Lawler Series

The Lawler series consists of somewhat poorly drained soils on alluvial terraces. These soils formed in loamy material underlain by sand and gravel. Permeability is moderate in the upper part of the profile and very rapid in the lower part. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Lawler soils are commonly adjacent to Coland, Marshan, Saude, Spillville, and Waukee soils. Coland soils are poorly drained. Their A horizon is thicker than that of the Lawler soils. Marshan soils are poorly drained. Saude and Waukee soils are well drained. They have no mottles in the B horizon. Also, Waukee soils have more clay in the B horizon than the Lawler soils. Spillville soils have an A horizon that is thicker than that of the Lawler soils. They are underlain by coarse textured material below a depth of 40 inches. Coland and Spillville soils are on bottom land. Marshan, Saude, and Spillville soils are in landscape positions similar to those of the Lawler soils.

Typical pedon of Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes; 1,120 feet west and 320 feet south of the center of sec. 16, T. 87 N., R. 5 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A—7 to 17 inches; very dark grayish brown (10YR 3/2) loam, dark gray (10YR 4/1) dry; continuous black (10YR 2/1) coatings on faces of peds; weak fine subangular structure; few pebbles; friable; neutral; clear smooth boundary.

BA—17 to 22 inches; dark grayish brown (10YR 4/2) loam; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; few fine distinct dark yellowish brown (10YR 4/4) and brown (10YR 4/3) mottles; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bw—22 to 28 inches; dark yellowish brown (10YR 4/4) loam; discontinuous dark grayish brown (10YR 4/2) coatings on faces of peds; common medium distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

BC—28 to 34 inches; yellowish brown (10YR 5/4) loam; common medium distinct yellowish brown (10YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; friable; about 10 percent gravel; slightly acid; abrupt wavy boundary.

2C—34 to 60 inches; yellowish brown (10YR 5/4 and 5/6) stratified sand and gravel; single grained; loose; neutral.

The depth to coarse textured material ranges from 24 to 40 inches. It generally is the same as the thickness of the solum.

The A horizon is loam or silt loam high in content of sand. The Ap horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1). Some pedons have an AB horizon, which is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). The surface soil is 12 to 18 inches thick. The upper part of the B horizon typically is dark grayish brown (10YR 4/2). In some pedons, however, it is dark yellowish brown (10YR 4/4) and is mottled with grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2). The Bw horizon generally is loam, but the range includes sandy clay loam. Some pedons have a 2BC horizon. This horizon or the C horizon is gravelly loamy sand or sand and gravel.

Lilah Series

The Lilah series consists of excessively drained, very rapidly permeable soils on upland ridgetops and alluvial terraces. These soils formed in loamy sediments 12 to 28 inches deep over sand and gravel. The native vegetation was mixed prairie grasses and deciduous trees. Slope ranges from 0 to 9 percent.

Lilah soils are commonly adjacent to Olin and Sparta soils on uplands and to Finchford, Lamont, and Wapsie soils on alluvial terraces. Olin and Sparta soils have a mollic epipedon. Olin soils have more clay in the substratum than the Lilah soils. Sparta soils do not contain gravel. Finchford soils are loamy sand in the part of the profile above the sand and gravel. Lamont soils do not contain gravel in the upper 60 inches. Wapsie soils have less sand in the solum than the Lilah soils.

Typical pedon of Lilah sandy loam, 0 to 2 percent slopes; 132 feet north and 628 feet west of the southeast corner of sec. 18, T. 87 N., R. 6 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

E—7 to 12 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure; friable; mixed with a small amount of brown (10YR 4/3) material; neutral; clear smooth boundary.

BE—12 to 20 inches; dark yellowish brown (10YR 4/4) sandy loam; some brown (7.5YR 4/4) streaks; weak medium and fine subangular blocky structure; friable; discontinuous light gray (10YR 7/2) dry sand and silt coatings on faces of peds; slightly acid; gradual smooth boundary.

Bt—20 to 27 inches; strong brown (7.5YR 5/6) sandy loam; weak medium subangular blocky structure; very friable; some clay bridging between sand grains; about 5 percent fine gravel; strongly acid; gradual smooth boundary.

2BC2—27 to 39 inches; brown (7.5YR 4/4) gravelly loamy sand; weak medium and fine subangular blocky structure parting to single grained; very friable; some clay bridging on sand grains and pebbles; about 20 percent fine gravel; medium acid; clear smooth boundary.

2C—39 to 60 inches; strong brown (7.5YR 5/6) sand; some brown (7.5YR 4/4) streaks; single grained; loose; about 2 percent gravel; medium acid.

The solum ranges from about 30 to 42 inches in thickness. It is medium acid to very strongly acid in the most acid part.

The A or Ap horizon typically is very dark grayish brown (10YR 3/2) but in some pedons is very dark brown (10YR 2/2) or brown (10YR 4/3). It is 6 to 9 inches thick. It typically is sandy loam, but the range includes loam. In some pedons the E horizon is incorporated into the Ap horizon. The Bt and 2BC horizons have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. The B horizon is sandy loam in the upper part and gravelly loamy sand or sand in the lower part.

Lindley Series

The Lindley series consists of moderately well drained, moderately slowly permeable soils on valley side slopes and narrowly dissected interfluves. These soils formed in loamy glacial till. The native vegetation was deciduous trees. Slope ranges from 9 to 18 percent.

Lindley soils are commonly adjacent to Downs, Exette, and Fayette soils. The adjacent soils are on the higher lying ridgetops and side slopes. They have less sand throughout the solum than the Lindley soils. Also, Downs soils have a darker surface layer, and Exette soils have a grayer subsoil and substratum.

Typical pedon of Lindley loam, 9 to 14 percent slopes, moderately eroded; 790 feet east and 530 feet south of the northwest corner of sec. 30, T. 88 N., R. 3 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; mixed with streaks and pockets of brown (7.5YR 4/4) clay loam subsoil material; weak fine and medium subangular blocky structure; friable; very strongly acid; abrupt smooth boundary.

BE—7 to 11 inches; brown (7.5YR 4/4) clay loam; continuous yellowish brown (10YR 5/4) coatings on faces of peds; moderate medium subangular and angular blocky structure; firm; strongly acid; clear smooth boundary.

Bt1—11 to 19 inches; strong brown (7.5YR 5/6) clay loam; moderate medium angular blocky structure; firm; discontinuous light gray (10YR 7/1) silt coatings; thin reddish brown (5YR 4/4) clay films; few fine black (10YR 2/1) concretions (manganese oxide); strongly acid; gradual smooth boundary.

Bt2—19 to 28 inches; strong brown (7.5YR 5/6) clay loam; yellowish brown (10YR 5/4) coatings on faces of peds; moderate medium subangular and angular blocky structure; firm; discontinuous light gray (10YR 7/1) silt coatings; thin reddish brown (5YR 4/4) clay films; few fine black (10YR 2/1) concretions (manganese oxide); strongly acid; gradual smooth boundary.

Bt3—28 to 36 inches; strong brown (7.5YR 5/6) clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; firm; discontinuous light gray (10YR 7/1) silt coatings; thin reddish brown (5YR 4/4) clay films; few fine black (10YR 2/1) concretions (manganese oxide); strongly acid; gradual smooth boundary.

BC—36 to 43 inches; strong brown (7.5YR 5/6) clay loam; yellowish brown (10YR 5/4) coatings on faces of peds; few medium distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure; firm; discontinuous light gray (10YR 7/1) silt coatings; common fine black (10YR 2/1) concretions (manganese oxide); strongly acid; gradual smooth boundary.

C—43 to 60 inches; yellowish brown (10YR 5/6) loam; few medium distinct grayish brown (10YR 5/2) mottles; massive; firm; many fine black (10YR 2/1) concretions (manganese oxide); slightly acid.

The thickness of the solum ranges from 30 to 50 inches. The A horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 1 to 4 inches thick. Typically, it is loam, but in some pedons it is silt loam or clay loam. The Ap horizon typically is dark grayish brown (10YR 4/2), but in some pedons it is brown (10YR 4/3). The E horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. In some pedons it is incorporated into the Ap horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is loam to clay loam. It is strongly acid to slightly acid. The C horizon typically is yellowish brown (10YR 5/6) but is strong brown (7.5YR 5/6) in some pedons. The BC and C horizons have mottles with hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 4.

Lourdes Series

The Lourdes series consists of moderately well drained soils on convex ridgetops and side slopes in the uplands. These soils formed in 12 to 22 inches of friable, loamy sediments and in the underlying very firm glacial till. Permeability is moderate in the upper part of the profile and moderately slow in the lower part. The native vegetation was prairie grasses and deciduous trees. Slope ranges from 2 to 5 percent.

Lourdes soils are similar to Cresken soils and are commonly adjacent to Cresken and Donnan soils. Cresken soils have a mollic epipedon and have less clay in the underlying glacial till than the Lourdes soils. They are in landscape positions similar to those of the Lourdes soils. Donnan soils are somewhat poorly drained and are on the higher lying ridgetops. They are underlain by a gray, clayey paleosol.

Typical pedon of Lourdes loam, 2 to 5 percent slopes; 2,140 feet east and 240 feet south of the northwest corner of sec. 14, T. 87 N., R. 6 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam (21 percent clay), grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

E—7 to 12 inches; dark grayish brown (10YR 4/2) loam (21 percent clay), light brownish gray (10YR 6/2) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy and weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

BE—12 to 17 inches; dark yellowish brown (10YR 4/4) loam (25 percent clay); discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

2Bt1—17 to 23 inches; yellowish brown (10YR 5/6) clay loam (30 percent clay); grayish brown (2.5Y 5/2) coatings on faces of peds; moderate medium angular and subangular blocky structure; very firm; stone line of small pebbles at a depth of 17 to 19 inches; strongly acid; gradual smooth boundary.

2Bt2—23 to 34 inches; yellowish brown (10YR 5/6) clay loam (33 percent clay); thick grayish brown (2.5Y 5/2) coatings on faces of peds; moderate medium prismatic structure parting to moderate medium angular blocky; very firm; strongly acid; gradual smooth boundary.

2BC—34 to 44 inches; yellowish brown (10YR 5/6) clay loam (33 percent clay); thick grayish brown (2.5Y 5/2) coatings on faces of peds; few fine distinct gray (10YR 6/1) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; very firm; medium acid; gradual smooth boundary.

2C1—44 to 54 inches; yellowish brown (10YR 5/6) clay loam (29 percent clay); common fine distinct gray (10YR 6/1) and few fine distinct strong brown (7.5YR 5/6) mottles; massive; very firm; slightly acid; abrupt wavy boundary.

2C2—54 to 60 inches; yellowish brown (10YR 5/6) clay loam (29 percent clay); few fine distinct strong brown (7.5YR 5/6) and gray (10YR 6/1) mottles; massive; very firm; few soft carbonate accumulations; slight effervescence; mildly alkaline.

The thickness of the solum typically is more than 40 inches but ranges from 36 to 60 inches. The loamy upper sediments are loam, and the glacial till is clay loam.

The Ap horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). The A horizon is black (10YR 2/1). The E horizon typically is dark grayish brown (10YR 4/2), but in some pedons it is brown (10YR 4/3). Typically, a stone line separates the loamy upper sediments from the very firm glacial till. The 2Bt horizon ranges from very strongly acid to neutral. It has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 to 8. The maximum clay content, which is in the 2Bt2 horizon, ranges from 30 to 38 percent.

Marshan Series

The Marshan series consists of poorly drained soils in depressions and other concave areas on alluvial terraces. These soils formed in loamy material underlain by sand and gravel. Permeability is moderate in the solum and rapid in the substratum. The native vegetation was water-tolerant prairie grasses. Slope ranges from 0 to 2 percent.

Marshan soils are commonly adjacent to Coland, Lawler, Palms, Saude, and Waukee soils. Coland soils have an A horizon that is thicker than that of the Marshan soils. They are on bottom land. Lawler soils are somewhat poorly drained. Palms soils formed in 16 to 50 inches of organic material. Saude and Waukee soils are well drained. Lawler, Saude, and Waukee soils are on convex and plane slopes on alluvial terraces. Palms soils are in landscape positions similar to those of the Marshan soils.

Typical pedon of Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes; 2,140 feet west and 135 feet north of the southeast corner of sec. 11, T. 88 N., R. 6 W.

Ap—0 to 7 inches; black (N 2/0) clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A—7 to 16 inches; black (N 2/0) clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; slightly acid; gradual smooth boundary.

AB—16 to 22 inches; very dark gray (5Y 3/1) clay loam, dark gray (10YR 4/1) dry; continuous black (5Y 2/1) coatings on faces of peds; few fine faint olive brown (2.5Y 4/4) mottles; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bg1—22 to 26 inches; dark gray (5Y 4/1) clay loam; few fine faint light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; friable; few yellowish brown (10YR 5/6) concretions (iron oxide); medium acid; gradual smooth boundary.

Bg2—26 to 34 inches; olive gray (5Y 5/2) clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; discontinuous dark gray (5Y 4/1) coatings on faces of peds; moderate fine subangular blocky structure; friable; medium acid; abrupt wavy boundary.

2BC—34 to 38 inches; light brownish gray (2.5Y 6/2) sandy loam; many fine prominent yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; friable; few strong brown (7.5YR 5/6) concretions (iron oxide); common pebbles 5 to 10 millimeters in size; medium acid; abrupt wavy boundary.

2C—38 to 60 inches; light brownish gray (2.5Y 6/2) gravelly sand; common fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; slightly acid.

The thickness of the solum and the depth to sand and gravel range from 24 to 40 inches. The solum is medium acid to neutral.

The A horizon is black (N 2/0, 5Y 2/1, or 10YR 2/1) or very dark gray (10YR 3/1). It is 12 to 24 inches thick. It is clay loam, silty clay loam high in content of sand, or loam. The Bg horizon has hue of 5Y, 2.5Y, or 10YR, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam or clay loam. The lower part of the B horizon typically is sandy loam, but the range includes loam and loamy sand. The 2C horizon typically is gravelly sand, but in some pedons it is stratified sand, coarse sand, and gravel.

Muscatine Series

The Muscatine series consists of somewhat poorly drained, moderately permeable soils on uplands at the head of drainageways. These soils formed in loess. The native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

Muscatine soils are adjacent to Downs and Tama soils. The adjacent soils are well drained and are on the steeper ridgetops and side slopes. Downs soils do not have a mollic epipedon.

Typical pedon of Muscatine silt loam, 1 to 3 percent slopes; 1,340 feet north and 625 feet east of the southwest corner of sec. 12, T. 88 N., R. 3 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam (25 percent clay), very dark gray (10YR 3/1) dry; weak fine granular and subangular blocky structure; friable; neutral; clear smooth boundary.

A—8 to 15 inches; black (10YR 2/1) silt loam (25 percent clay), very dark gray (10YR 3/1) dry; weak fine granular and subangular blocky structure; friable; neutral; clear smooth boundary.

AB—15 to 22 inches; very dark brown (10YR 2/2) silt loam (25 percent clay), very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) dry; discontinuous black (10YR 2/1) coatings on faces of peds; weak fine granular and subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Bt1—22 to 29 inches; dark grayish brown (2.5Y 4/2) silty clay loam (30 percent clay); moderate fine subangular blocky structure; friable; discontinuous very dark brown (10YR 2/2) clay films on faces of peds; dark red (2.5YR 3/6) oxides; slightly acid; clear smooth boundary.

Bt2—29 to 36 inches; olive brown (2.5Y 4/4) and dark grayish brown (2.5Y 4/2) silty clay loam (33 percent clay); few fine distinct yellowish brown (10YR 5/6) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; discontinuous very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine black (10YR 2/1) oxides; friable; slightly acid; gradual smooth boundary.

Bt3—36 to 43 inches; grayish brown (2.5Y 5/2) silty clay loam (30 percent clay); few fine distinct yellowish brown (10YR 5/6) mottles; weak fine prismatic structure; friable; discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; few fine distinct black (10YR 2/1) oxides; slightly acid; gradual smooth boundary.

C—43 to 60 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) silt loam (24 percent clay); common fine distinct strong brown (7.5YR 5/6) mottles; massive; friable; few fine distinct black (10YR 2/1) oxides; slightly acid.

The solum ranges from 40 to 60 inches in thickness. The A horizon is typically silt loam but is silty clay loam in some pedons. It is black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1). It is 15 to 23 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It has mottles with hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The content of clay in this horizon typically is 27 to

32 percent, but in some pedons it can be as high as 34 percent.

Newvienna Series

The Newvienna series consists of moderately well drained, moderately permeable soils on convex upland side slopes and nose slopes. These soils formed in silty loess. The native vegetation was prairie grasses and deciduous trees. Slope ranges from 5 to 14 percent.

Newvienna soils are similar to Downs soils and are commonly adjacent to Downs, Ely, and Fayette soils. Downs soils have no mottles within a depth of 30 inches. Ely soils are somewhat poorly drained and are lower on the landscape than the Newvienna soils. Also, they have a thicker surface soil. Fayette soils have a surface layer that is thinner than that of the Newvienna soils. They are well drained. Their landscape positions are similar to those of the Newvienna soils.

Typical pedon of Newvienna silt loam, 5 to 9 percent slopes, moderately eroded; 1,950 feet west and 140 feet south of the northeast corner of sec. 1, T. 89 N., R. 3 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam (21 percent clay), grayish brown (10YR 5/2) dry; mixed with some streaks and pockets of yellowish brown (10YR 5/4) subsoil material; very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

BE—7 to 11 inches; yellowish brown (10YR 5/4) silt loam (21 percent clay); mixed with a few streaks and pockets of very dark grayish brown (10YR 3/2) material from the surface layer; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bt1—11 to 21 inches; yellowish brown (10YR 5/4) silty clay loam (29 percent clay); moderate medium and fine angular blocky structure; friable; discontinuous dark yellowish brown (10YR 4/4) clay films; few fine black (10YR 2/1) oxides; medium acid; gradual smooth boundary.

Bt2—21 to 27 inches; yellowish brown (10YR 5/4) silty clay loam (29 percent clay); few fine faint grayish brown (10YR 5/2) mottles; weak fine prismatic structure parting to moderate medium angular blocky; friable; discontinuous dark yellowish brown (10YR 4/4) clay films; few fine black (10YR 2/1) oxides; medium acid; gradual smooth boundary.

BC—27 to 34 inches; yellowish brown (10YR 5/4) silt loam (21 percent clay); common fine distinct grayish brown (10YR 5/2) and few fine faint yellowish brown (10YR 5/8) mottles; weak fine prismatic structure; friable; discontinuous dark yellowish brown (10YR 4/4) clay films; few fine black (10YR 2/1) oxides; slightly acid; gradual smooth boundary.

C—34 to 60 inches; yellowish brown (10YR 5/4) silt loam (21 percent clay); few fine and medium distinct grayish brown (10YR 5/2) and few medium distinct yellowish brown (10YR 5/8) mottles; massive; slightly acid.

The solum ranges from 30 to 45 inches in thickness. The Ap horizon is very dark grayish brown (10YR 3/2), dark brown (10YR 3/3), or dark grayish brown (10YR 4/2). It is 5 to 8 inches thick. Most pedons have a BE horizon, which has hue of 10YR and value and chroma of 3 or 4. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The mottles in this horizon have hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 8. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 8. The content of clay ranges from 21 to 32 percent in the upper part of the solum and in the substratum.

Nordness Series

The Nordness series consists of shallow, well drained, moderately permeable soils on upland ridges and side slopes. These soils formed in loess and in the underlying clayey material weathered from limestone bedrock. The native vegetation was deciduous trees. Slope ranges from 2 to 60 percent.

Nordness soils are commonly adjacent to Backbone, Bertram, Dubuque, Fayette, Goss, and Whalan soils. Backbone and Bertram soils have more sand in the solum than the Nordness soils and are 20 to 40 inches deep over limestone bedrock. Dubuque soils have limestone bedrock at a depth of more than 20 inches. Fayette soils are not underlain by limestone bedrock. Goss soils formed in loamy sediments and in the underlying material weathered from cherty limestone. Whalan soils typically are loam in the upper part and are 20 to 40 inches deep over limestone bedrock. Backbone, Bertram, Goss, and Whalan soils are on ridgetops above the Nordness soils. Dubuque and Fayette soils are on ridges and side slopes.

Typical pedon of Nordness silt loam, 14 to 25 percent slopes; 1,410 feet east and 265 feet south of the northwest corner of sec. 16, T. 90 N., R. 6 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; discontinuous very dark gray (10YR 3/1) coatings on faces of peds; weak fine granular structure; friable; slightly acid; clear smooth boundary.

E—4 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; friable; medium acid; clear smooth boundary.

Bt1—8 to 14 inches; brown (10YR 4/3) silt loam; dark grayish brown (10YR 4/2) coatings on faces of peds; weak fine subangular blocky structure; friable; thin discontinuous light gray (10YR 7/1) dry silt coatings; medium acid; clear smooth boundary.

2Bt2—14 to 18 inches; brown (7.5YR 4/4) silty clay; strong medium and fine angular blocky structure; firm; thin discontinuous light gray (10YR 7/1) dry silt coatings; thin discontinuous dark brown (7.5YR 3/2) clay films; slightly acid; abrupt smooth boundary.
2R—18 inches; hard fractured limestone bedrock.

The thickness of the solum and the depth to the limestone bedrock range from 8 to 20 inches. The solum is neutral to medium acid in the most acid part. It commonly has limestone fragments throughout the lower part.

The A horizon is very dark gray (10YR 3/1), dark gray (10YR 4/1), or very dark grayish brown (10YR 3/2). It is 1 to 4 inches thick. The Ap horizon is dark grayish brown (10YR 4/2). The A and E horizons typically are silt loam, but the range includes loam. The 2Bt horizon is clay or silty clay. It is 1 to 5 inches thick.

Olin Series

The Olin series consists of well drained soils on upland side slopes and interfluves. These soils formed in 20 to 36 inches of very friable, loamy eolian sediments and in the underlying firm glacial till. Permeability is moderately rapid in the upper part of the profile and moderate in the lower part. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Olin soils are similar to Kenyon soils and are commonly adjacent to Dickinson, Kenyon, Lilah, and Sparta soils. Kenyon soils have less sand and more clay in the loamy upper sediments than the Olin soils. Dickinson and Sparta soils are not underlain by glacial till within a depth of 60 inches. Sparta soils are coarse textured throughout the solum. Lilah soils are underlain by gravel at 30 to 42 inches. Dickinson, Kenyon, and Sparta soils are on upland side slopes and ridgetops. Lilah soils are cone-shaped mounds on ridgetops.

Typical pedon of Olin fine sandy loam, 2 to 5 percent slopes; 2,244 feet west and 370 feet north of the southeast corner of sec. 19, T. 87 N., R. 6 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; slightly acid; clear smooth boundary.
A—7 to 15 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; strongly acid; gradual smooth boundary.
AB—15 to 21 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; discontinuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure; very friable; strongly acid; gradual smooth boundary.
Bw1—21 to 28 inches; brown (10YR 4/3) sandy loam; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds in the upper part; weak fine subangular blocky structure; very friable; strongly acid; clear smooth boundary.
2Bw2—28 to 33 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; firm; stone line at a depth of 28 inches; thin strata of friable dark yellowish brown (10YR 4/4) sandy loam in the lower part; medium acid; clear smooth boundary.
2Bw3—33 to 41 inches; yellowish brown (10YR 5/4) loam; continuous brown (10YR 4/3) coatings on faces of peds; common fine faint yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few black (10YR 2/1) concretions (manganese oxide); medium acid; gradual smooth boundary.
2BC—41 to 46 inches; yellowish brown (10YR 5/6) loam; few fine faint grayish brown (10YR 5/2) and few medium distinct yellowish red (5YR 5/8) mottles; weak coarse prismatic structure; firm; common black (10YR 2/1) concretions (manganese oxide); slightly acid; gradual smooth boundary.
2C—46 to 60 inches; yellowish brown (10YR 5/6) loam; few fine faint strong brown (7.5YR 5/8) and common fine faint grayish brown (10YR 5/2) mottles; massive; firm; common dark reddish brown (5YR 2/2) concretions (manganese and iron oxides); slightly acid.

The solum ranges from 40 to 60 inches in thickness. It is medium acid or strongly acid in the most acid part. The loamy upper sediments are fine sandy loam or sandy loam, and the glacial till is loam or clay loam.

The A horizon is black (10YR 2/1) or very dark brown (10YR 2/2). The Ap horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). The surface soil ranges from 14 to 24 inches in thickness. Some pedons have a BA horizon, which is dark brown (10YR 3/3) or brown (10YR 4/3). The Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Typically, a stone line is at the boundary between the B and 2B horizons. The 2B horizon has hue of 10YR, value of 3 to 5, and chroma of 3 to 6. Mottles with chroma of 1 or 2 are commonly below a depth of 30 inches. The 2C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8 and typically has mottles with chroma of 1 or 2.

Olin Variant

The Olin Variant consists of well drained soils on upland ridgetops and side slopes. These soils formed in loamy eolian sediments and in the underlying glacial till. Permeability is moderately rapid in the upper part of the profile and moderate in the lower part. The native vegetation was mixed grasses and deciduous trees. Slope ranges from 2 to 9 percent.

Olin Variant soils are similar to Bassett soils and are commonly adjacent to Backbone, Bassett, and Chelsea soils. The adjacent soils are in landscape positions similar to those of the Olin Variant soils. Bassett soils have more clay and less sand in the upper loamy sediments than the Olin Variant soils. Backbone soils are underlain by limestone bedrock at a depth of 20 to 40 inches. Chelsea soils are dominantly loamy fine sand and fine sand throughout the solum.

Typical pedon of Olin Variant sandy loam, 2 to 5 percent slopes; 2,090 feet east and 180 feet south of the northwest corner of sec. 21, T. 88 N., R. 4 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

E—8 to 14 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure; friable; slightly acid; clear smooth boundary.

BE—14 to 24 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) sandy loam; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

2Bt1—24 to 28 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; few small pebbles 5 to 10 millimeters in size; discontinuous dark yellowish brown (10YR 4/4) clay films; medium acid; gradual smooth boundary.

2Bt2—28 to 32 inches; yellowish brown (10YR 5/4 and 5/6) loam; weak fine subangular blocky structure; firm; discontinuous dark yellowish brown (10YR 4/4) clay films; medium acid; gradual smooth boundary.

2Bt3—32 to 39 inches; yellowish brown (10YR 5/4) loam; few fine distinct strong brown (7.5YR 4/6) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; light brownish gray (10YR 6/2) silt coatings on faces of prisms; medium acid; gradual smooth boundary.

2BC—39 to 44 inches; yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) loam; common fine distinct grayish brown (10YR 5/2) mottles; weak fine prismatic structure; firm; few fine black (10YR 2/1) concretions (manganese oxide); slightly acid; gradual smooth boundary.

2C—44 to 60 inches; strong brown (7.5YR 5/6) loam; common fine distinct grayish brown (10YR 5/2) mottles; massive; firm; few fine black (10YR 2/1) concretions (manganese oxide); slightly acid.

The upper loamy sediments range from 20 to 36 inches in thickness. They are fine sandy loam or sandy loam. The underlying glacial till is loam, sandy clay loam, or clay loam. The solum is medium acid to very strongly acid in the most acid part.

The Ap horizon is very dark grayish brown (10YR 3/2). The A horizon, if it occurs, is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). Typically, a stone line is at the boundary between the upper loamy sediments and the glacial till. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The 2B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 8. Typically, mottles with chroma of 1 or 2 are in the lower part of the 2B horizon and in the 2C horizon.

Oran Series

The Oran series consists of somewhat poorly drained, moderately permeable soils on broad upland ridges. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation was grasses and deciduous trees. Slope ranges from 1 to 3 percent.

Oran soils are similar to Readlyn soils and are commonly adjacent to Bassett, Clyde, and Floyd soils. Readlyn soils have a mollic epipedon. Bassett soils are brown in the upper part of the subsoil. They are moderately well drained and in the more sloping areas below the Oran soils. Clyde and Floyd soils are in the lower lying drainageways. They are 30 to 50 inches deep to glacial till and have a mollic epipedon. Also, Clyde soils are poorly drained.

Typical pedon of Oran loam, 1 to 3 percent slopes; 330 feet south and 130 feet east of the center of sec. 4, T. 87 N., R. 6 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam (21 percent clay), dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

E1—7 to 12 inches; dark grayish brown (10YR 4/2) loam (21 percent clay), light brownish gray (10YR 6/2) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure; friable; slightly acid; clear smooth boundary.

E2—12 to 16 inches; brown (10YR 4/3) loam (18 percent clay), pale brown (10YR 6/3) dry; weak thin platy structure; friable; slightly acid; clear smooth boundary.

BE—16 to 20 inches; olive brown (2.5Y 4/4) loam (21 percent clay); common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; stone line of many 1- to 3-inch stones in the lower part; medium acid; clear smooth boundary.

2Bt1—20 to 24 inches; mottled yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) loam (26 percent clay); weak fine subangular blocky structure; firm;

thin discontinuous clay films; slightly acid; clear smooth boundary.

2Bt2—24 to 31 inches; mottled yellowish brown (10YR 5/6) and gray (10YR 5/1) loam (26 percent clay); weak fine prismatic structure parting to weak medium subangular blocky; firm; thin discontinuous clay films; few fine black (10YR 2/1) concretions (manganese oxide); strongly acid; clear smooth boundary.

2Bt3—31 to 44 inches; mottled yellowish brown (10YR 5/6) and gray (10YR 5/1) loam (26 percent clay); few fine distinct strong brown (7.5YR 5/8) mottles; weak fine prismatic structure; firm; thin discontinuous clay films; few fine black (10YR 2/1) concretions (manganese oxide); slightly acid; clear smooth boundary.

2BC—44 to 49 inches; yellowish brown (10YR 5/6) loam (25 percent clay); common fine distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure; firm; slightly acid; clear wavy boundary.

2C—49 to 60 inches; strong brown (7.5YR 5/6) loam (21 percent clay); common medium distinct gray (10YR 5/1) mottles; massive; firm; few fine soft carbonate accumulations; strong effervescence; mildly alkaline.

The solum typically is more than 40 inches thick but ranges from 36 to 50 inches. It is strongly acid in the most acid part. The depth to carbonates ranges from 40 to 70 inches. The loamy upper sediments are 14 to 26 inches deep over the glacial till. They typically are loam, but the range includes silt loam in which the content of sand is 10 to 15 percent.

The Ap horizon typically is very dark brown (10YR 2/2), but the range includes very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2). The E horizon typically is dark grayish brown (10YR 4/2), but the range includes brown (10YR 4/3). The BE horizon typically is olive brown (2.5Y 4/4), but the range includes grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2). A stone line is near the base of the BE horizon, at a depth of 14 to 24 inches. The 2B horizon generally is mottled with hue of 2.5Y, 10YR, or 7.5YR, value of 4 to 6, and chroma o. 2 to 8. It typically is loam but in some pedons has thin layers of clay loam.

Ossian Series

The Ossian series consists of poorly drained, moderately permeable soils on broad bottom land and low lying stream terraces. These soils formed in silty alluvium. The native vegetation was water-tolerant prairie grasses. Slope ranges from 0 to 2 percent.

Ossian soils are similar to Rowley soils and are commonly adjacent to Downs, Ely, and Fayette soils. Rowley soils are somewhat poorly drained. Downs and Fayette soils are well drained and are on upland side slopes. Ely soils are somewhat poorly drained and are on foot slopes.

Typical pedon of Ossian silt loam, 0 to 2 percent slopes; 120 feet north and 925 feet west of the southeast corner of sec. 24, T. 90 N., R. 6 W.

Ap—0 to 8 inches; black (N 2/0) silt loam, black (10YR 2/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A—8 to 16 inches; black (N 2/0) silt loam, black (10YR 2/1) dry; moderate fine and medium granular structure; friable; neutral; gradual smooth boundary.

BA—16 to 22 inches; very dark gray (2.5Y 3/1) silt loam, dark gray (10YR 4/1) dry; common fine distinct olive gray (5Y 4/2) mottles; moderate fine subangular blocky structure; friable; few fine yellowish brown (10YR 5/6) concretions (iron oxide); neutral; clear smooth boundary.

Bg—22 to 33 inches; dark gray (5Y 4/1) silt loam; common medium distinct grayish brown (2.5Y 5/2) mottles; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

BCg—33 to 42 inches; olive gray (5Y 5/2) silt loam; gray (5Y 5/1) coatings on faces of peds; many fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; few fine black (10YR 2/1) concretions (manganese oxide); neutral; gradual smooth boundary.

C1—42 to 52 inches; gray (5Y 5/1) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; common fine black (10YR 2/1) concretions (manganese oxide); neutral; gradual smooth boundary.

C2—52 to 60 inches; light olive gray (5Y 6/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; fine medium black (5YR 2/1) concretions (manganese oxide); neutral.

The solum ranges from 30 to 50 inches in thickness. It generally is neutral, but some pedons have slightly acid horizons. The depth to carbonates is more than 40 inches.

The A horizon is black (N 2/0 or 10YR 2/1) or very dark gray (10YR 3/1). It is 12 to 22 inches thick. The BA horizon has hue of 10YR or 2.5Y, value of 3, and chroma of 1 or 2. It has distinct mottles with chroma of 2 to 4. The BA and Bg horizons are silt loam or silty clay loam in which the content of clay is 24 to 28 percent. The Bg and BCg horizons typically have hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 or 2. Coarse textured strata are not evident within a depth of 60 inches.

Palms Series

The Palms series consists of very poorly drained soils in areas of hillside seeps or depressions on uplands and alluvial terraces. These soils formed in organic material over alluvial or glacial sediments. Permeability is moderately slow to moderately rapid. The native vegetation was water-tolerant grasses and sedges. Slope ranges from 1 to 4 percent.

Palms soils are commonly adjacent to Clyde, Marshan, Olin, and Sparta soils. Clyde and Marshan soils are lower in content of organic matter than the Palms soils. They are poorly drained. They are in landscape positions similar to those of the Palms soils. Olin and Sparta soils are on upland side slopes. Olin soils are well drained. They are sandy loam or fine sandy loam in the upper part. Sparta soils are excessively drained. They formed in eolian sand.

Typical pedon of Palms muck, 1 to 4 percent slopes; 1,320 feet west and 165 feet south of the center of sec. 9, T. 89 N., R. 6 W.

Oa1—0 to 9 inches; black (N 2/0) sapric material, black (N 2/0) dry; less than 5 percent herbaceous fibers, a trace rubbed; weak fine subangular blocky and granular structure; sticky; about 20 percent mineral material; slightly acid; clear smooth boundary.

Oa2—9 to 22 inches; black (N 2/0) sapric material, black (N 2/0) dry; less than 5 percent herbaceous fibers, a trace rubbed; weak medium subangular blocky structure; sticky; about 10 to 15 percent mineral material; slightly acid; gradual smooth boundary.

Oa3—22 to 47 inches; black (N 2/0) sapric material, black (N 2/0) dry; about 10 percent herbaceous fibers, less than 5 percent rubbed; weak medium subangular blocky structure; sticky; about 5 to 10 percent mineral material; slightly acid; clear smooth boundary.

2Cg—47 to 60 inches; very dark gray (10YR 3/1) silt loam; about 5 to 10 percent herbaceous fibers; few fine distinct dark yellowish brown (10YR 4/4) mottles; massive; friable; neutral.

The sapric material generally ranges from 18 to 50 inches in thickness. The fibers are derived primarily from herbaceous plants.

The sapric material is black (N 2/0 or 10YR 2/1) or very dark brown (10YR 2/2). The 2Cg horizon has hue of 10YR to 5Y, value from 3 to 5, and chroma of 1 or 2. It is neutral or slightly acid. It typically is silt loam, silty clay loam, or loam, but the texture varies.

Protivin Series

The Protivin series consists of somewhat poorly drained soils on slightly concave upland side slopes. These soils formed in 14 to 28 inches of friable, loamy sediments and in the underlying very firm glacial till. Permeability is moderate in the upper part of the profile and moderately slow in the lower part. The native vegetation was prairie grasses. Slope ranges from 1 to 4 percent.

Protivin soils are similar to Readlyn soils and are commonly adjacent to Cresken and Donnan soils. Readlyn soils have less clay in the underlying glacial till than the Protivin soils. Cresken and Donnan soils are on the higher lying ridgetops and side slopes. Cresken soils are moderately well drained. Donnan soils do not have a mollic epipedon and are underlain by a gray, clayey paleosol.

Typical pedon of Protivin loam, 1 to 4 percent slopes; 2,240 feet north and 100 feet east of the southwest corner of sec. 20, T. 88 N., R. 6 W.

Ap—0 to 7 inches; black (10YR 2/1) loam (21 percent clay), very dark gray (10YR 3/1) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A—7 to 14 inches; black (10YR 2/1) loam (21 percent clay), very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; medium acid; gradual smooth boundary.

BA—14 to 18 inches; dark grayish brown (2.5Y 4/2) loam (21 percent clay); discontinuous very dark gray (10YR 3/1) coatings on faces of peds; few fine faint yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

Bt1—18 to 22 inches; olive brown (2.5Y 4/4) loam (26 percent clay); discontinuous dark grayish brown (2.5Y 4/2) coatings on faces of peds; common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

2Bt2—22 to 33 inches; grayish brown (2.5Y 5/2) clay loam (29 percent clay); common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; very firm; medium acid; gradual smooth boundary.

2Bt3—33 to 40 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) clay loam (29 percent clay); moderate medium prismatic structure parting to weak fine subangular blocky; very firm; grayish brown (10YR 5/2) evident on faces of prisms; medium acid; gradual smooth boundary.

2BC—40 to 44 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) clay loam (29 percent clay); weak medium prismatic structure; very firm; few medium distinct brown (7.5YR 4/4) concretions (manganese oxide); slightly acid; gradual smooth boundary.

2C—44 to 60 inches; mottled yellowish brown (10YR 5/8) and light brownish gray (2.5Y 6/2) clay loam (25 percent clay); massive; very firm; slightly acid.

The thickness of the solum typically is more than 40 inches but ranges from 36 to 60 inches. Unless lime has been applied, reaction is medium acid or strongly acid in the A and B horizons. It is medium acid to mildly alkaline in the 2B horizon.

The A horizon typically is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). It ranges from 12 to 18 inches in thickness. The BA horizon typically is dark grayish brown (10YR 4/2 or 2.5Y 4/2), but it has chroma of 3 or 4 in pedons that have mottles with chroma of 2 or less. Typically, a stone line separates the loamy upper sediments from the very firm glacial till. The 2B horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 5 or 6, and chroma of 2 to 6. The content of clay in this horizon ranges from 28 to 35 percent. The 2C horizon is clay loam or loam in which the content of clay ranges from 24 to 30 percent.

Readlyn Series

The Readlyn series consists of somewhat poorly drained, moderately permeable soils on uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

Readlyn soils are similar to Oran and Protivin soils and are commonly adjacent to Floyd and Kenyon soils. Oran soils do not have a mollic epipedon. Protivin soils have a higher clay content in the subsoil than the Readlyn soils. Floyd soils are 30 to 50 inches deep to glacial till. They are in the lower lying drainageways. Kenyon soils are moderately well drained and are on convex side slopes.

Typical pedon of Readlyn loam, 1 to 3 percent slopes; 1,980 feet north and 800 feet west of the southeast corner of sec. 7, T. 88 N., R. 6 W.

Ap—0 to 8 inches; black (10YR 2/1) loam (21 percent clay), very dark gray (10YR 3/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A—8 to 12 inches; very dark brown (10YR 2/2) loam (21 percent clay), very dark grayish brown (10YR 3/2) dry; continuous black (10YR 2/1) coatings on faces of peds; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

BA—12 to 17 inches; dark grayish brown (2.5Y 4/2) loam (21 percent clay), grayish brown (2.5Y 5/2) dry; continuous very dark brown (10YR 2/2) coatings on faces of peds; few fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Bw1—17 to 23 inches; olive brown (2.5Y 4/4) loam (21 percent clay); few fine faint dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; thin stone line at a depth of 23 inches; slightly acid; gradual smooth boundary.

2Bw2—23 to 29 inches; yellowish brown (10YR 5/4) loam (24 percent clay); few fine distinct yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) mottles; weak fine subangular blocky structure; firm; slightly acid; gradual smooth boundary.

2Bw3—29 to 41 inches; yellowish brown (10YR 5/4) loam (24 percent clay); common medium distinct grayish brown (2.5Y 5/2) and few fine distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; few fine black (10YR 2/1) concretions (manganese oxide); neutral; gradual smooth boundary.

2BC—41 to 49 inches; yellowish brown (10YR 5/6) loam (25 percent clay); discontinuous grayish brown (10YR 5/2) coatings on faces of peds; common medium distinct strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine black (10YR 2/1) concretions (manganese oxide); neutral; gradual smooth boundary.

2C—49 to 60 inches; yellowish brown (10YR 5/6) loam (21 percent clay); common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; massive; firm; common fine carbonate threads; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. It commonly coincides with the depth to carbonates. The depth to glacial till ranges from 14 to 24 inches. Typically, a thin stone line is at the boundary between the loamy upper sediments and the glacial till.

The A horizon is black (10YR 2/1) or very dark brown (10YR 2/2) in the upper part and very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) in the lower part. It typically is loam, but the range includes silty clay loam and silt loam high in content of sand. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 8. It has mottles with hue of 2.5Y, 10YR, or 7.5YR. The 2B and 2C horizons typically are loam, but the range includes clay loam.

Richwood Series

The Richwood series consists of well drained, moderately permeable soils on alluvial terraces. These soils formed in silty alluvium. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Richwood soils are commonly adjacent to Bertrand, Rowley, and Worthen soils. Bertrand and Rowley soils are in landscape positions similar to those of the Richwood soils. Bertrand soils do not have a mollic epipedon. Their native vegetation was deciduous trees. Rowley soils are somewhat poorly drained. Worthen soils have an A horizon that is thicker than that of the Richwood soils. They are on foot slopes.

Typical pedon of Richwood silt loam, 0 to 2 percent slopes; 1,200 feet south and 350 feet west of the northeast corner of sec. 3, T. 87 N., R. 4 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam (18.3 percent clay), very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

A1—7 to 14 inches; very dark brown (10YR 2/2) silt loam (18.3 percent clay), very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

A2—14 to 21 inches; very dark grayish brown (10YR 3/2) silt loam (20.7 percent clay), dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

BA—21 to 27 inches; brown (10YR 4/3) silt loam (22.8 percent clay); discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid; clear smooth boundary.

Bt1—27 to 32 inches; dark yellowish brown (10YR 4/4) silt loam (25.9 percent clay); discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium subangular blocky structure; friable; discontinuous dark brown (7.5YR 3/2) clay films on faces of peds; discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid; clear smooth boundary.

Bt2—32 to 39 inches; dark yellowish brown (10YR 4/4) silt loam (24.3 percent clay); weak fine prismatic structure parting to weak medium subangular blocky structure; friable; discontinuous brown (7.5YR 4/4) clay films on faces of peds and dark brown (7.5YR 3/2) clay films in root channels; nearly continuous light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

BC—39 to 46 inches; yellowish brown (10YR 5/4) silt loam (20.6 percent clay); weak fine prismatic structure; friable; discontinuous brown (7.5YR 4/4) clay films on faces of peds; thin light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

C—46 to 60 inches; yellowish brown (10YR 5/6) silt loam (20.6 percent clay); massive; evidence of stratification in the lower part; friable; slightly acid.

The solum ranges from 40 to 60 inches in thickness. It is slightly acid or medium acid in the most acid part.

The Ap or A horizon is very dark brown (10YR 2/2) or black (10YR 2/1). The surface soil ranges from 14 to 24 inches in thickness. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It typically is silt loam, but the range includes silty clay loam. The content of clay in this horizon is 24 to 29 percent.

Rockton Series

The Rockton series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in loamy sediments and in the underlying clayey material weathered from limestone bedrock. The native vegetation was prairie grasses. Slope ranges from 2 to 5 percent.

Rockton soils are commonly adjacent to Backbone, Bassett, Bertram, Sogn, and Terril soils. Backbone, Bassett, and Bertram soils are in landscape positions similar to those of the Rockton soils. Backbone and Bertram soils have a sandy loam texture above the limestone. Bassett soils do not have limestone bedrock within a depth of 60 inches. Sogn soils have limestone bedrock at a depth of 4 to 20 inches. They are on convex side slopes. Terril soils are underlain by sand. They are in upland drainageways.

Typical pedon of Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes; 1,055 feet south and 530 feet east of the center of sec. 22, T. 89 N., R. 6 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A—8 to 16 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; continuous black (10YR 2/1) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

BA—16 to 20 inches; brown (10YR 4/3) loam; continuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bt1—20 to 25 inches; brown (10YR 4/3) loam; discontinuous dark brown (10YR 3/3) coatings on faces of peds; weak medium subangular blocky structure; friable; thin discontinuous dark brown (7.5YR 3/2) clay films; medium acid; gradual smooth boundary.

2Bt2—25 to 28 inches; brown (7.5YR 4/4) silty clay; moderate fine subangular blocky structure; friable; thin discontinuous dark brown (7.5YR 3/4) clay films; about 5 percent chert and gravel; medium acid; abrupt wavy boundary.

2R—28 inches; limestone bedrock that is weathered along joints and partially fractured.

The thickness of the solum and the depth to limestone bedrock range from 20 to 40 inches. Reaction is medium acid or strongly acid in the most acid horizon.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is 10 to 18 inches thick. It typically is loam, but the range includes silt loam high in content of sand. The B horizon has hue of 10YR in the upper part and hue of 7.5YR or 10YR in the lower part. It has value of 4 or 5 and chroma of 3 or 4. The 2B horizon is silty clay or clay loam in which the content of clay ranges from 28 to 45 percent. This horizon is as much as 6 inches thick in some pedons. In other pedons, however, it occurs only as thin rinds of clayey material around limestone flagstones.

Rowley Series

The Rowley series consists of somewhat poorly drained, moderately permeable soils on alluvial terraces. These soils formed in silty alluvium. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Rowley soils are similar to the poorly drained Ossian soils and are commonly adjacent to the well drained Bertrand, Richwood, Tell, and Worthen soils. Bertrand and Tell soils do not have a mollic epipedon. Also, Tell soils have sand within a depth of 40 inches. Bertrand and Richwood soils are in landscape positions similar to those of the Rowley soils. Tell soils are in gently sloping areas on the alluvial terraces. Worthen soils are on foot slopes and in upland drainageways.

Typical pedon of Rowley silt loam, 0 to 2 percent slopes; 1,440 feet east and 40 feet south of the northwest corner of sec. 35, T. 88 N., R. 4 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam (20 percent clay), dark grayish brown (10YR 4/2) dry; continuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; abrupt smooth boundary.

A—7 to 15 inches; very dark brown (10YR 2/2) silt loam (20 percent clay), dark grayish brown (10YR 4/2) dry; weak thin platy and weak very fine subangular blocky structure; friable; medium acid; clear wavy boundary.

BA—15 to 20 inches; dark grayish brown (10YR 4/2) silt loam (20 percent clay); discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure; friable; few reddish brown (5YR 4/4) concretions (iron oxide); strongly acid; clear smooth boundary.

Bt1—20 to 33 inches; grayish brown (10YR 5/2) silt loam (25 percent clay); discontinuous dark grayish brown (10YR 4/2) coatings on faces of peds; common fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky and moderate fine angular blocky structure; friable; few fine black (10YR 2/1) concretions (manganese oxide); strongly acid; gradual smooth boundary.

Bt2—33 to 43 inches; grayish brown (10YR 5/2) silt loam (25 percent clay); common fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; friable; thin discontinuous dark yellowish brown (10YR 4/4) clay films; strongly acid; gradual smooth boundary.

BC1—43 to 52 inches; grayish brown (10YR 5/2) silt loam (20 percent clay); common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; friable; few fine black (10YR 2/1) concretions (manganese oxide); strongly acid; gradual smooth boundary.

2BC2—52 to 60 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) silt loam (15 percent clay); strata of sandy loam 1 to 2 inches thick at depths of 54 and 58 inches; weak medium prismatic structure; friable; strongly acid.

The solum typically is 50 to 60 inches thick but ranges from 45 to 65 inches. It ranges from neutral to strongly acid.

The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The surface soil typically is 12 to 20 inches thick, but in some pedons it is 24 inches thick. The BA horizon and the AB horizon, if it occurs, typically have platy structure but in some pedons have subangular blocky structure. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 4. In pedons where it has chroma of 3 or 4, it has mottles with chroma of 2 or less. It is silt loam or silty clay loam. The 2B and 2C horizons have hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 8.

Saude Series

The Saude series consists of well drained soils on alluvial terraces. These soils formed in loamy material underlain by sand and gravel. Permeability is moderate in the upper part of the profile and very rapid in the lower part. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Saude soils are similar to Flagler, Wapsie, and Waukee soils and are commonly adjacent to Flagler, Lawler, Spillville, and Waukee soils. Flagler soils have sandy loam layers above the sand and gravel. Wapsie soils do not have a mollic epipedon. Waukee soils are 32 to 40 inches deep to sand and gravel. Lawler soils are somewhat poorly drained. Spillville soils are underlain by sandy loam and loamy sand at a depth of more than 40 inches. They are somewhat poorly drained and are on bottom land. Flagler, Lawler, and Waukee soils are in landscape positions similar to those of the Saude soils.

Typical pedon of Saude loam, 0 to 2 percent slopes; 2,240 feet west and 185 feet north of the southeast corner of sec. 11, T. 88 N., R. 6 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A—7 to 13 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; medium acid; clear smooth boundary.

BA—13 to 17 inches; dark brown (10YR 3/3) loam; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bw—17 to 25 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; strongly acid; clear smooth boundary.

BC—25 to 29 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few pebbles 5 to 10 millimeters in size; strongly acid; abrupt wavy boundary.

2C1—29 to 51 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grained; loose; common fine black (10YR 2/1) and reddish brown (5YR 4/4) concretions (oxide); strongly acid; gradual smooth boundary.

2C2—51 to 60 inches; yellowish brown (10YR 5/6) sand; single grained; loose; few pebbles 2 to 5 millimeters in size in the lower part; strongly acid.

The A or Ap horizon is black (10YR 2/1) or very dark brown (10YR 2/2). The surface soil typically is 11 to 16 inches, but in some pedons it is as thick as 20 inches. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The content of clay is 15 to 20 percent in this horizon. In the control section, it is, by weighted average, less than 18 percent. The B and 2B horizons are slightly acid to strongly acid. The depth to loamy sand, gravelly sand, or sand typically is 24 to 32 inches but ranges from 18 to 36 inches. The coarse textured material is acid, and carbonates are leached to a depth of 6 feet or more.

Sawmill Series

The Sawmill series consists of poorly drained, moderately permeable soils in upland drainageways. These soils formed in silty alluvium. The native vegetation was water-tolerant grasses. Slope ranges from 1 to 4 percent.

Sawmill soils are similar to Colo soils and are commonly adjacent to Aredale, Dinsdale, and Tama soils. The A horizon of Colo soils is thicker than that of the Sawmill soils. Aredale, Dinsdale, and Tama soils are well drained and are on upland ridgetops and side slopes. Aredale soils have sandy loam and loamy sand in the subsoil and substratum. Dinsdale soils have a substratum of loamy glacial till.

Typical pedon of Sawmill silty clay loam, 1 to 4 percent slopes; 165 feet west and 2,080 feet south of the northeast corner of sec. 36, T. 90 N., R. 5 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam (29 percent clay), very dark gray (N 3/0) dry; weak fine subangular blocky and granular structure; friable; neutral; abrupt smooth boundary.

A1—8 to 18 inches; black (5Y 2/1) silty clay loam (33 percent clay), very dark gray (N 3/0) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

A2—18 to 23 inches; very dark gray (10YR 3/1) silty clay loam (33 percent clay), dark gray (10YR 4/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

AB—23 to 28 inches; very dark gray (10YR 3/1) silty clay loam (33 percent clay), dark gray (10YR 4/1) dry; few fine distinct light olive brown (2.5Y 5/4) and olive (5Y 5/4) mottles; moderate very fine subangular blocky and weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bg—28 to 33 inches; dark gray (5Y 4/1) silty clay loam (33 percent clay); common fine distinct light olive brown (2.5Y 5/4) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; few fine black (10YR 2/1) concretions (manganese oxide); slightly acid; clear smooth boundary.

BCg—33 to 41 inches; olive gray (5Y 5/2) silty clay loam (33 percent clay); common fine distinct yellowish brown (10YR 5/8) mottles; weak fine prismatic structure; friable; few fine black (10YR 2/1) concretions (manganese oxide); medium acid; clear smooth boundary.

C—41 to 60 inches; olive gray (5Y 5/2) silty clay loam (33 percent clay); common medium distinct yellowish brown (10YR 5/8) mottles; massive; friable; few fine black (10YR 2/1) concretions (manganese oxide); medium acid.

The solum ranges from 36 to 60 inches in thickness. The Ap or A horizon is black (N 2/0, 5Y 2/1, or 10YR 2/1) or very dark brown (10YR 2/2). The surface soil ranges from 24 to 36 inches in thickness. The Bg horizon has hue of 5Y or 2.5Y, value of 3 to 5, and chroma of 1 or 2. In most pedons it has distinct mottles with hue of 2.5Y, 10YR, or 5Y, value of 4 or 5, and chroma of 3 to 8. The C horizon typically is silty clay loam, but the range includes silt loam. The content of clay in this horizon ranges from 25 to 35 percent.

Schley Series

The Schley series consists of somewhat poorly drained, moderately permeable soils in slightly concave drainageways on uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation was prairie grasses and deciduous trees. Slope ranges from 1 to 5 percent.

Schley soils are similar to Floyd soils and are commonly adjacent to Bassett, Coggon, and Floyd soils. Floyd soils have a mollic epipedon. They are in landscape positions similar to those of the Schley soils. Bassett and Coggon soils are moderately well drained and are on convex ridgetops and side slopes.

Typical pedon of Schley loam, 1 to 4 percent slopes; 725 feet west and 330 feet north of the southeast corner of sec. 19, T. 87 N., R. 6 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; mixed with streaks and pockets of dark grayish brown (10YR 4/2) loam subsurface material; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

E1—7 to 13 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure; friable; slightly acid; clear smooth boundary.

E2—13 to 18 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; few medium faint yellowish brown (10YR 5/6) mottles; weak thin platy structure parting to weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

BE—18 to 22 inches; olive brown (2.5Y 4/4) loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bt1—22 to 27 inches; mottled yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; discontinuous clay films on faces of peds; few fine distinct black (10YR 2/1) concretions (manganese oxide); medium acid; clear smooth boundary.

Bt2—27 to 36 inches; yellowish brown (10YR 5/4) loam; common medium distinct grayish brown (2.5Y 5/2) mottles; weak fine subangular blocky structure; firm; discontinuous clay films on faces of peds; few fine distinct black (10YR 2/1) concretions (manganese oxide); strongly acid; gradual smooth boundary.

2BC—36 to 44 inches; mottled strong brown (7.5YR 5/8) and grayish brown (2.5Y 5/2) loam; continuous grayish brown (2.5Y 5/2) coatings on faces of peds; common fine faint yellowish red (5YR 5/8) mottles; weak medium prismatic structure; firm; few fine distinct black (10YR 2/1) concretions (manganese oxide); strongly acid; gradual smooth boundary.

2C—44 to 60 inches; strong brown (7.5YR 5/6) loam; many medium distinct grayish brown (2.5Y 5/2) mottles; massive; firm; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to glacial till ranges from 30 to 50 inches. Reaction is medium acid to very strongly acid in the most acid horizon. The depth to carbonates is more than 60 inches.

The A or Ap horizon typically is black (10YR 2/1), but the range includes very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2). The E horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). Typically, it is loam, but the range includes silt loam high in content of sand. The Bt horizon generally is loam, silt loam high in content of sand, or clay loam. Strata of sandy loam, however, are common in the lower part. The 2BC horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. It typically is loam, but the range includes clay loam. Typically, the 2C horizon is loam. In some pedons, however, it is clay loam, and in other pedons it is loamy sand to a depth of 5 or 6 feet.

Seaton Series

The Seaton series consists of well drained, moderately permeable soils on convex ridgetops and side slopes in the uplands. These soils formed in loess. The native vegetation was deciduous trees. Slope ranges from 9 to 18 percent.

Seaton soils are similar to Fayette soils and are commonly adjacent to Chelsea, Fayette, and Lamont soils. The adjacent soils are in landscape positions similar to those of the Seaton soils. Fayette soils have more clay and less coarse silt in the subsoil than the Seaton soils. Chelsea soils formed in eolian sand and are excessively drained. Lamont soils formed in moderately coarse textured and coarse textured eolian sediments.

Typical pedon of Seaton silt loam, 9 to 14 percent slopes, moderately eroded; 2,110 feet west and 330 feet north of the center of sec. 2, T. 90 N., R. 6 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam (15 percent clay), grayish brown (10YR 5/2) dry; mixed with some streaks and pockets of yellowish brown (10YR 5/4) silt loam subsoil material; weak fine subangular blocky structure; friable; estimated 15 percent sand; slightly acid; abrupt smooth boundary.

Bt1—6 to 10 inches; yellowish brown (10YR 5/4) silt loam (18 percent clay); weak medium and fine subangular blocky structure; friable; slightly discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—10 to 17 inches; yellowish brown (10YR 5/4) silt loam (24 percent clay); weak medium subangular blocky structure; friable; continuous brown (10YR 4/3) clay films; slightly acid; clear smooth boundary.

Bt3—17 to 25 inches; yellowish brown (10YR 5/4) silt loam (24 percent clay); moderate medium subangular blocky structure; friable; continuous brown (10YR 4/3) clay films; slightly acid; clear smooth boundary.

Bt4—25 to 35 inches; yellowish brown (10YR 5/4) silt loam (24 percent clay); weak medium prismatic structure parting to weak fine subangular blocky; friable; discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; discontinuous dark yellowish brown (10YR 4/4) clay films; strongly acid; clear smooth boundary.

BC—35 to 52 inches; yellowish brown (10YR 5/4) silt loam (18 percent clay); weak coarse prismatic structure; friable; discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; strongly acid; clear smooth boundary.

C—52 to 60 inches; yellowish brown (10YR 5/4) silt loam (15 percent clay); massive; friable; strongly acid.

The solum ranges from 45 to more than 70 inches in thickness.

In uncultivated areas the A horizon is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3). It is 2 to 5 inches thick. In cultivated areas the Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3). The E horizon, if it occurs, is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or brown (10YR 4/3). It is 3 to 5 inches thick. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The content of clay in this horizon ranges from 18 to 27 percent. The ratio of coarse silt to fine silt commonly is 1.5 or more. The B horizon is medium acid or strongly acid. The C horizon has colors similar to those of the B horizon, but in some pedons it has some mottles with chroma of 2 to 6.

Sogn Series

The Sogn series consists of shallow, somewhat excessively drained, moderately permeable soils on short upland side slopes. These soils formed in loamy sediments underlain by limestone bedrock. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

These soils are taxadjuncts to the Sogn series because they formed under a more humid moisture regime than is definitive for the series.

Sogn soils are commonly adjacent to Backbone, Bertram, Rockton, and Terril soils. Backbone, Bertram, and Rockton soils are 20 to 40 inches deep over limestone. They are on ridgetops. Backbone and Bertram soils have more sand in the solum than the Sogn soils. Also, Backbone soils do not have a mollic epipedon. Terril soils are underlain by sand. They are in upland drainageways.

Typical pedon of Sogn loam, 2 to 9 percent slopes; 790 feet west and 100 feet north of the center of sec. 20, T. 87 N., R. 3 W.

A1—0 to 10 inches; very dark brown (10YR 2/2) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; neutral; gradual smooth boundary.

A2—10 to 16 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; about 1 percent channery limestone with strong effervescence in the lower part; neutral; abrupt wavy boundary.

2R—16 inches; hard fractured limestone; rectangular flagstones about 3 feet long and 2 feet thick.

The thickness of the solum and the depth to limestone bedrock range from 4 to 20 inches. The A horizon is very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). It is silt loam, sandy loam, or loam. In some pedons a 2- to 4-inch layer of silty clay or clay residuum is between the A horizon and the limestone bedrock.

Sparta Series

The Sparta series consists of excessively drained, rapidly permeable soils on uplands and alluvial terraces. These soils formed in eolian sand. The native vegetation was prairie grasses. Slope ranges from 0 to 9 percent.

Sparta soils are commonly adjacent to Dickinson, Lilah, Olin, and Schley soils. Lilah soils have gravel in the substratum. Dickinson soils have less sand in the upper part of the solum than the Sparta soils. Olin soils formed in loamy material and in the underlying glacial till. Schley soils are somewhat poorly drained and are in upland drainageways. Dickinson, Lilah, and Olin soils are on upland side slopes and ridgetops.

Typical pedon of Sparta loamy fine sand, 2 to 5 percent slopes; 990 feet west and 265 feet south of the center of sec. 33, T. 88 N., R. 6 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) loamy fine sand (75 percent sand), dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

A—7 to 17 inches; very dark grayish brown (10YR 3/2) loamy fine sand (85 percent sand), grayish brown (10YR 5/2) dry; discontinuous very dark brown (10YR 2/2) coatings on faces of peds; weak medium subangular blocky and weak fine granular structure; very friable; slightly acid; gradual smooth boundary.

BA—17 to 23 inches; brown (10YR 4/3) loamy fine sand (85 percent sand), brown (10YR 5/3) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium subangular blocky and weak fine granular structure; very friable; medium acid; gradual wavy boundary.

Bw—23 to 37 inches; yellowish brown (10YR 5/4) loamy fine sand (85 percent sand); discontinuous brown (10YR 4/3) coatings on faces of peds; weak medium subangular blocky structure; very friable; common roots extend to a depth of 27 inches; strongly acid; gradual wavy boundary.

BC—37 to 44 inches; yellowish brown (10YR 5/6) loamy fine sand (85 percent sand); discontinuous dark yellowish brown (10YR 4/4) coatings on faces of peds; weak medium subangular blocky structure; very friable; strongly acid; gradual wavy boundary.

C—44 to 60 inches; brownish yellow (10YR 6/6) fine sand (95 percent sand); single grained; loose; brown (7.5YR 4/4) 1/2-inch iron bands at depths of 50 and 58 inches; strongly acid.

The solum ranges from 24 to 45 inches in thickness. It is medium acid or strongly acid in the most acid part. It is loamy fine sand, loamy sand, or fine sand.

The A horizon ranges from 10 to 24 inches in thickness. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The C horizon is sand or fine sand free of gravel.

Spillville Series

The Spillville series consists of moderately well drained and somewhat poorly drained, moderately permeable soils on bottom land. These soils formed in loamy alluvium. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Spillville soils are similar to Coland soils and are commonly adjacent to Coland, Lawler, and Saude soils. Coland soils contain more clay in the solum than the Spillville soils. They are poorly drained. Their positions on the landscape are similar to those of the Spillville soils. Lawler and Saude soils have an A horizon that is thinner than that of the Spillville soils and are underlain by sand and gravel at a depth of 20 to 40 inches. They are on the higher lying alluvial terraces.

Typical pedon of Spillville loam, in an area of Spillville-Coland complex, 0 to 2 percent slopes; 860 feet south and 140 feet east of the northwest corner of sec. 28, T. 89 N., R. 6 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A1—7 to 20 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; medium acid; gradual smooth boundary.

A2—20 to 36 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; very weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

A3—36 to 41 inches; very dark gray (10YR 3/1) and dark brown (10YR 3/3) loam, dark gray (10YR 4/1) dry; very weak fine subangular blocky structure; friable; few fine yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) concretions (iron oxide); slightly acid; clear smooth boundary.

C1—41 to 51 inches; brown (10YR 4/3) loam; common fine distinct yellowish brown (10YR 5/4) mottles; massive; friable; few fine yellowish brown (10YR 5/6) and common medium black (10YR 2/1) concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

C2—51 to 60 inches; mottled yellowish brown (10YR 5/4 and 5/6) and light brownish gray (10YR 6/2) sandy loam; massive; friable; few fine black (10YR 2/1) concretions (manganese oxide); slightly acid.

The solum typically is about 45 inches thick but ranges from 30 to 56 inches. It is neutral or slightly acid. The depth to carbonates is 5 feet or more.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). It typically is more than 40 inches thick but ranges from 36 to 52 inches. It typically is loam, but the range includes silt loam high in content of sand. The C horizon is dominantly loam or sandy loam but in some pedons has strata of loamy sand. It has few to many mottles, which commonly have hue of 10YR but can also have hue of 2.5Y.

Tama Series

The Tama series consists of well drained, moderately permeable soils on convex ridgetops and side slopes in the uplands. These soils formed in loess. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Tama soils are similar to Dinsdale and Downs soils and are commonly adjacent to Colo, Dinsdale, Downs, Ely, and Sawmill soils. Dinsdale and Downs soils are in landscape positions similar to those of the Tama soils. Dinsdale soils typically are loam in the lower part of the subsoil and in the substratum. Downs soils do not have a mollic epipedon. Colo, Ely, and Sawmill soils are in drainageways. Colo and Sawmill soils are poorly drained, and Ely soils are somewhat poorly drained.

Typical pedon of Tama silt loam, 2 to 5 percent slopes; 1,025 feet east and 825 feet north of the center of sec. 17, T. 90 N., R 3 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam (24 percent clay), very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A—7 to 16 inches; very dark brown (10YR 2/2) silt loam (24 percent clay), very dark grayish brown (10YR 3/2) dry; weak fine granular and subangular blocky structure; friable; medium acid; clear smooth boundary.

AB—16 to 20 inches; very dark grayish brown (10YR 3/2) silt loam (24 percent clay), dark grayish brown (10YR 4/2) dry; discontinuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

Bt1—20 to 25 inches; brown (10YR 4/3) silty clay loam (29 percent clay); discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; thin discontinuous clay films; medium acid; clear smooth boundary.

Bt2—25 to 32 inches; dark yellowish brown (10YR 4/4) silty clay loam (29 percent clay); moderate medium subangular blocky structure; friable; thin discontinuous clay films; discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid; clear smooth boundary.

BC—32 to 40 inches; yellowish brown (10YR 5/4) silty clay loam (24 percent clay); weak medium subangular blocky structure; friable; discontinuous clay films; discontinuous light gray (10YR 7/1) silt coatings on faces of peds; few fine black (10YR 2/1) concretions (manganese oxide); medium acid; clear smooth boundary.

C—40 to 60 inches; yellowish brown (10YR 5/4) silt loam (21 percent clay); few fine distinct grayish brown (10YR 5/2) mottles; massive; friable; few fine black (10YR 2/1) concretions (manganese oxide); medium acid.

The thickness of the solum ranges from 36 to 60 inches. The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). It is silt loam in which the content of clay is 22 to 27 percent. It ranges from 12 to 20 inches in thickness. The B horizon has hue of 10YR, value of 3 to 5, and chroma of 3 to 6. The Bt horizon is silty clay loam in which the content of clay ranges from 27 to 34 percent.

Tell Series

The Tell series consists of well drained soils on terraces and uplands. These soils formed in silty and loamy material underlain by coarse alluvium or outwash. Permeability is moderate in the solum and is rapid in the substratum. The native vegetation was deciduous trees. Slope ranges from 2 to 5 percent.

Tell soils are commonly adjacent to Bertrand, Chelsea, and Fayette soils. Bertrand soils are more than 40 inches deep to a coarse textured substratum. They are in landscape positions similar to those of the Tell soils. Chelsea and Fayette soils are on upland side slopes and ridgetops. Chelsea soils are coarse textured throughout the solum. Fayette soils formed in more than 60 inches of silty loess.

Typical pedon of Tell silt loam, 2 to 5 percent slopes; 800 feet north and 330 feet west of the center of sec. 35, T. 88 N., R. 4 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

E—7 to 11 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam, grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) dry; weak thin platy structure; friable; slightly acid; clear smooth boundary.

BE—11 to 16 inches; dark yellowish brown (10YR 4/4) silty clay loam; continuous brown (10YR 4/3) coatings on faces of peds; weak fine and medium subangular blocky structure; friable; medium acid; clear smooth boundary.

Bt—16 to 26 inches; yellowish brown (10YR 5/4) silty clay loam; continuous brown (10YR 4/3) coatings on faces of peds; moderate medium subangular blocky structure; friable; few thin light gray (10YR 7/1) silt coatings on faces of peds; few thin clay films on faces of peds; strongly acid; gradual wavy boundary.

2BC—26 to 30 inches; brown (10YR 5/3) loam; discontinuous brown (10YR 4/3) coatings on faces of peds; weak medium subangular blocky structure; friable; strongly acid; abrupt wavy boundary.

2C1—30 to 41 inches; yellowish brown (10YR 5/4) loamy sand; single grained; loose; medium acid; gradual wavy boundary.

2C2—41 to 60 inches; yellowish brown (10YR 5/4) sand; single grained; loose; strata of silty clay loam 1 to 2 inches thick at a depth of 57 inches; about 5 percent chert fragments; medium acid.

The thickness of the solum ranges from 20 to 40 inches. In some pedons it corresponds to the depth to loamy sand or sand.

The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3) silt loam. It is 6 to 9 inches thick. The E horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is silt loam 4 to 6 inches thick. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The BE and Bt horizons typically are silty clay loam, but the range includes silt loam in which the content of clay is 25 to 30 percent. The BC horizon typically is loam, but the range includes clay loam. The 2C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is loamy sand or sand. In some pedons the content of fine gravel in this horizon is 10 to 15 percent.

Terril Series

The Terril series consists of well drained soils in upland drainageways. These soils formed in local alluvium. Permeability is moderate in the upper part of the profile and rapid in the lower part. The native vegetation was prairie grasses. Slope ranges from 2 to 5 percent.

Terril soils are commonly adjacent to Nordness, Rockton, and Sogn soils on ridgetops and side slopes. Nordness and Sogn soils are underlain by limestone bedrock within a depth of 20 inches. Rockton soils are underlain by limestone bedrock at a depth of 20 to 40 inches.

Typical pedon of Terril loam, sandy substratum, 2 to 5 percent slopes; 1,580 feet north and 200 feet west of the southeast corner of sec. 2, T. 88 N., R. 5 W.

A1—0 to 7 inches; black (10YR 2/1) loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A2—7 to 14 inches; black (10YR 2/1) silt loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A3—14 to 21 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A4—21 to 31 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; few chert fragments 5 to 20 millimeters in diameter; slightly acid; clear smooth boundary.

Bw—31 to 39 inches; very dark grayish brown (10YR 3/2) sandy loam; discontinuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular structure; friable; slightly acid; abrupt wavy boundary.

2C—39 to 60 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) sand; single grained; loose; 10 to 15 percent chert fragments; few small granite pebbles; slightly acid.

The solum ranges from 30 to 42 inches in thickness. It is loam or silt loam in the upper part and sandy loam or loam in the lower part. The A horizon is black (10YR 2/1) or very dark brown (10YR 2/2). The content of chert fragments in the 2C horizon ranges from 10 to 20 percent.

Wapsie Series

The Wapsie series consists of well drained soils on alluvial terraces. These soils formed in loamy material underlain by sand and gravel. Permeability is moderate in the solum and very rapid in the substratum. The native vegetation was mixed prairie grasses and trees. Slope ranges from 0 to 2 percent.

Wapsie soils are similar to Saude soils and are commonly adjacent to Flagler, Hayfield, Lilah, and Saude soils. The adjacent soils are in landscape positions similar to those of the Wapsie soils. Saude and Flagler soils have a mollic epipedon. Flagler and Lilah soils are sandy loam or fine sandy loam in the surface layer and in the upper part of the subsoil. Hayfield soils are somewhat poorly drained.

Typical pedon of Wapsie loam, 0 to 2 percent slopes; 260 feet west and 1,490 feet south of the center of sec. 18, T. 87 N., R. 6 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

E—7 to 11 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; friable; neutral; clear smooth boundary.

BE—11 to 17 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; nearly continuous light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt1—17 to 22 inches; brown (10YR 4/3) loam; few fine faint brown (7.5YR 4/4) mottles; weak medium and fine subangular blocky structure; friable; discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few thin discontinuous clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—22 to 29 inches; brown (7.5YR 4/4) gravelly sandy clay loam; weak medium subangular blocky structure; friable; discontinuous clay films; clay bridging between sand grains and pebbles; 15 to 20 percent gravel; medium acid; clear smooth boundary.

2C—29 to 60 inches; brown (7.5YR 5/4) gravelly loamy sand; single grained; loose; about 20 percent gravel; medium acid.

The thickness of the solum ranges from 24 to 40 inches. The depth to contrasting textures of loamy sand or sand ranges from 24 to 32 inches.

The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is 6 to 9 inches thick. The E horizon typically is dark grayish brown (10YR 4/2) but in some pedons is brown (10YR 4/3) or grayish brown (10YR 5/2). In some pedons it is incorporated into the Ap horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The B horizon typically is loam or gravelly sandy clay loam, but in some pedons it is sandy loam or loamy sand in the lower part. The 2C horizon is gravelly loamy sand or sand and gravel.

Waubeek Series

The Waubeek series consists of well drained, moderately permeable soils on convex ridges and side slopes in the uplands. These soils formed in loess and in the underlying glacial till. The native vegetation was mixed prairie grasses and trees. Slope ranges from 2 to 9 percent.

Waubeek soils are similar to Dinsdale and Downs soils and are commonly adjacent to those soils. Dinsdale soils have a mollic epipedon. Downs soils do not have glacial till within 60 inches of the surface. Both soils are in landscape positions similar to those of the Waubeek soils.

Typical pedon of Waubeek silt loam, 2 to 5 percent slopes; 890 feet west and 130 feet north of the southeast corner of sec. 27, T. 87 N., R. 5 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam (21 percent clay), grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

E—7 to 11 inches; dark grayish brown (10YR 4/2) silt loam (21 percent clay), light brownish gray (10YR 6/2) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy and weak very fine subangular blocky structure; friable; medium acid; clear smooth boundary.

Bt1—11 to 16 inches; brown (10YR 4/3) silty clay loam (29 percent clay); discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

Bt2—16 to 22 inches; dark yellowish brown (10YR 4/4) silty clay loam (29 percent clay); weak fine subangular blocky structure; friable; brown (10YR 4/3) clay films on faces of peds; medium acid; clear smooth boundary.

2Bt3—22 to 27 inches; yellowish brown (10YR 5/4) loam (26 percent clay); weak fine subangular blocky structure; friable; brown (10YR 4/3) clay films on faces of peds; few coarse pebbles in the upper part; medium acid; friable; clear smooth boundary.

2Bt4—27 to 36 inches; yellowish brown (10YR 5/4 and 5/6) loam (24 percent clay); few fine distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; thin discontinuous grayish brown (2.5Y 5/2) silt coatings on faces of peds; strongly acid; gradual smooth boundary.

2BC—36 to 42 inches; yellowish brown (10YR 5/4) loam (21 percent clay); few fine distinct strong brown (7.5YR 5/6) mottles; weak fine prismatic structure; firm; discontinuous grayish brown (2.5Y 5/2) silt coatings on faces of peds; medium acid; gradual smooth boundary.

2C—42 to 60 inches; yellowish brown (10YR 5/4) loam (21 percent clay); few fine distinct grayish brown (10YR 5/2) mottles; massive; firm; medium acid.

The thickness of the solum ranges from about 42 to 60 inches. The loess typically is 20 to 36 inches thick but ranges from 20 to 40 inches.

The Ap horizon is commonly very dark grayish brown (10YR 3/2). In some pedons, however, it is very dark brown (10YR 2/2) or very dark gray (10YR 3/1). The BE horizon is commonly brown (10YR 4/3) but is dark yellowish brown (10YR 4/4) in some pedons. The Bt horizon is silt loam or silty clay loam. The 2B horizon is yellowish brown (10YR 5/4 or 5/6). It is generally loam but in some pedons is sandy clay loam. It typically has a stone line in the upper part.

Waukee Series

The Waukee series consists of well drained soils in areas on alluvial terraces where slopes are convex. These soils formed in loamy material and in the underlying sand and gravel. Permeability is moderate in the upper part of the profile and very rapid in the lower part. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Waukee soils are similar to Saude soils and are commonly adjacent to Lawler, Marshan, and Saude soils. Saude soils formed in loamy material 24 to 32 inches deep over sand and gravel. They are in landscape positions similar to those of the Waukee soils. Lawler and Marshan soils are on concave slopes. Lawler soils are somewhat poorly drained, and Marshan soils are poorly drained.

Typical pedon of Waukee loam, 0 to 2 percent slopes; 925 feet north and 1,320 feet west of the southeast corner of sec. 12, T. 87 N., R. 5 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A1—7 to 16 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; black (10YR 2/1) coatings on faces of peds; weak fine granular and very weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

A2—16 to 21 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; discontinuous dark brown (10YR 3/3) coatings on faces of peds; weak very fine subangular blocky structure; friable; medium acid; clear smooth boundary.

BA—21 to 26 inches; dark brown (10YR 3/3) loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

Bw—26 to 35 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; pebbles in the lower part; medium acid; abrupt wavy boundary.

2BC—35 to 41 inches; yellowish brown (10YR 5/4) gravelly loamy sand; very weak medium subangular blocky structure; friable; medium acid; abrupt wavy boundary.

2C—41 to 60 inches; yellowish brown (10YR 5/4) sand and gravel; single grained; loose; strongly acid.

The thickness of the solum typically is 30 to 40 inches but ranges from 30 to 48 inches. In some pedons it corresponds to the depth to coarse loamy sand or gravelly sand. The lower part of the A horizon and the B horizon are medium acid or strongly acid.

The A1 or Ap horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). It typically is loam, but the range includes silt loam high in content of sand. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, sandy clay loam, sandy loam, or gravelly loamy sand. The 2C horizon is loamy sand, gravelly sand, or sand. The content of gravel in this horizon typically is about 10 to 20 percent but ranges to 50 percent.

Whalan Series

The Whalan series consists of moderately deep, well drained, moderately permeable soils in convex areas on upland ridges. These soils formed in loamy sediments and in the underlying clayey material weathered from limestone bedrock. The native vegetation was deciduous hardwoods. Slope ranges from 2 to 9 percent.

Whalan soils are commonly adjacent to Backbone, Coggon, Goss, and Nordness soils. Backbone soils are moderately coarse textured. Coggon and Goss soils do not have limestone bedrock within a depth of 60 inches. Also, Goss soils have chert fragments and red residuum in the subsoil. Nordness soils have limestone bedrock at a depth of 8 to 20 inches. They are on convex side slopes. Backbone, Coggon, and Goss soils are in landscape positions similar to those of the Whalan soils.

Typical pedon of Whalan loam, 30 to 40 inches to limestone, 2 to 5 percent slopes; 1,320 feet south and 595 feet west of the northeast corner of sec. 29, T. 89 N., R. 6 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

E—4 to 11 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure; friable; medium acid; clear smooth boundary.

BE—11 to 18 inches; brown (10YR 4/3) loam; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

Bt1—18 to 24 inches; yellowish brown (10YR 5/6) loam; weak fine subangular blocky structure; friable; few pebbles; medium acid; clear smooth boundary.

Bt2—24 to 30 inches; yellowish brown (10YR 5/6) clay loam; weak fine subangular blocky structure; friable; few pebbles; strongly acid; abrupt wavy boundary.

2Bt3—30 to 34 inches; brown (7.5YR 5/4) and strong brown (7.5YR 5/6) clay; moderate fine and medium angular blocky structure; very firm; dark yellowish brown (10YR 4/4) clay films; few fine black (10YR 2/1) concretions (manganese oxide); medium acid; abrupt wavy boundary.

2R—34 inches; limestone bedrock that is weathered along joints and partially fractured.

The thickness of the solum and the depth to limestone bedrock range from 20 to 40 inches. In timbered areas the A horizon typically is very dark grayish brown (10YR 3/2), but the range includes black (10YR 2/1) and very dark gray (10YR 3/1). In cultivated areas the Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3). The E horizon typically is dark grayish brown (10YR 4/2) but is grayish brown (10YR 5/2) in some pedons. The upper part of the B horizon is brown (10YR 4/3) or yellowish brown (10YR 5/6). The BE and Bt horizons are loam or clay loam. The Bt horizon ranges from slightly acid to very strongly acid. The 2Bt horizon is clay or silty clay. It generally is 2 to 6 inches thick but is as much as 12 inches thick in a few pedons.

Worthen Series

The Worthen series consists of well drained, moderately permeable soils on alluvial fans, on foot slopes, and in upland drainageways. These soils formed in silty local alluvium more than 60 inches thick. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Worthen soils are similar to Ely soils and are commonly adjacent to Bertrand, Richwood, and Rowley soils. Ely soils are somewhat poorly drained. Bertrand, Richwood, and Rowley soils are on alluvial terraces. Bertrand soils are sandy in the substratum. The surface soil of Richwood soils is thinner than that of the Worthen soils. Rowley soils are somewhat poorly drained.

Typical pedon of Worthen silt loam, 2 to 5 percent slopes; 1,350 feet east and 200 feet north of the center of sec. 6, T. 90 N., R. 3 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky and granular structure; friable; slightly acid; abrupt smooth boundary.

A1—8 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky and granular structure; friable; medium acid; gradual smooth boundary.

A2—15 to 28 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; medium acid; gradual smooth boundary.

A3—28 to 39 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; discontinuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular structure; friable; medium acid; gradual smooth boundary.

BA—39 to 45 inches; dark brown (10YR 3/3) silt loam; discontinuous very dark gray (10YR 3/1) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bw—45 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; discontinuous dark brown (10YR 3/3) coatings on faces of peds; weak medium subangular blocky structure; medium acid.

The thickness of the solum ranges from 40 to 60 inches. The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). It is 24 to 40 inches thick. The B horizon is silt loam in which the content of clay ranges from 18 to 26 percent. It has hue of 10YR, value of 3 or 4, and chroma of 3 to 6. The Bw horizon is neutral to medium acid. Some pedons have few faint mottles in the lower part of the BC horizon and in the C horizon.

Formation of the Soils

This section relates the factors of soil formation to the soils in Delaware County. It also describes the processes that result in the formation of soil horizons.

Factors of Soil Formation

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and has existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material (*4*). Human activities also affect soil formation.

Climate and plant and animal life, chiefly plants, are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for horizon differentiation. Generally, a long period is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the others.

Parent Material

The accumulation of parent material is the first step in the formation of a soil. Some thin layers of several soils in the county formed as a result of the weathering of bedrock in place. Most of the soils, however, formed in material that was transported from the site of parent rock and redeposited at a new location through the action of glacial ice, water, wind, and gravity.

The principal parent materials in Delaware County are glacial drift, loess, alluvium, and eolian sand. Much less extensive are organic deposits and residuum.

Glacial drift is the most extensive parent material in Delaware County. It is all rock material transported and deposited by glacial ice, including glacial till and the material sorted by melt water. Glacial till is unsorted sediment in which particles range in size from boulders to clay. At least twice during the glacial period, continental glaciers moved over the land. These ice invasions are evidenced by the unconsolidated rock material that was deposited by the melting ice and melt water streams. The older ice sheet, known as the Nebraskan, covered the area about 750,000 years ago (*10*). It was followed by the Aftonian interglacial period. The Kansan Glaciation probably started 500,000 years ago. A more recent glaciation, the Iowa substage of the Wisconsin Glaciation, was recognized in a study published in 1933 (*6*). Recent studies of Iowan glacial till indicate that the conclusions formed from studies made before 1960 are questionable. Intensive, detailed geomorphic and stratigraphic work shows that the landscape is a multilevel sequence of erosion surfaces and that many of the levels are cut into Kansan and Nebraskan till (*11*). Landscapes similar to those in Delaware County have been studied in detail (*10*). Subsurface investigations and studies demonstrate that the Iowan till does not exist but that an erosion-surface complex does exist in the Iowa region. The Iowan surface is arranged in a series of steps from the major drainageways toward the bounding divides. It is marked by a stone line where it cuts through Kansan and Nebraskan till. The stone line occurs on all levels of the stepped surfaces and under the alluvium along the drainageways.

Bassett, Clyde, Cresken, Donnan, Floyd, Kenyon, Oran, Protivin, and Readlyn soils formed in loamy sediments and in the underlying glacial till on the Iowan erosion surface (fig. 13). The loamy sediments generally are about 1 to 2 feet deep over the glacial material. They are deeper, however, in areas of Clyde, Floyd, and other soils on the lower concave slopes and in drainageways. A stone line or band of pebbles commonly separates the friable, loamy surficial sediments from the firm loam or clay loam glacial till (*9*).

Loess, or silty wind-deposited material, covers about 72,000 acres in Delaware County, or nearly 20 percent of the total acreage. The base of the loess is 16,500 to 29,000 years old (*10*). The loess was deposited during the Wisconsin age. It consists mostly of silt and some clay. It does not contain coarse sand or gravel, which are too large to be deposited by wind, but the content of fine sand and very fine sand is about 5 percent. The

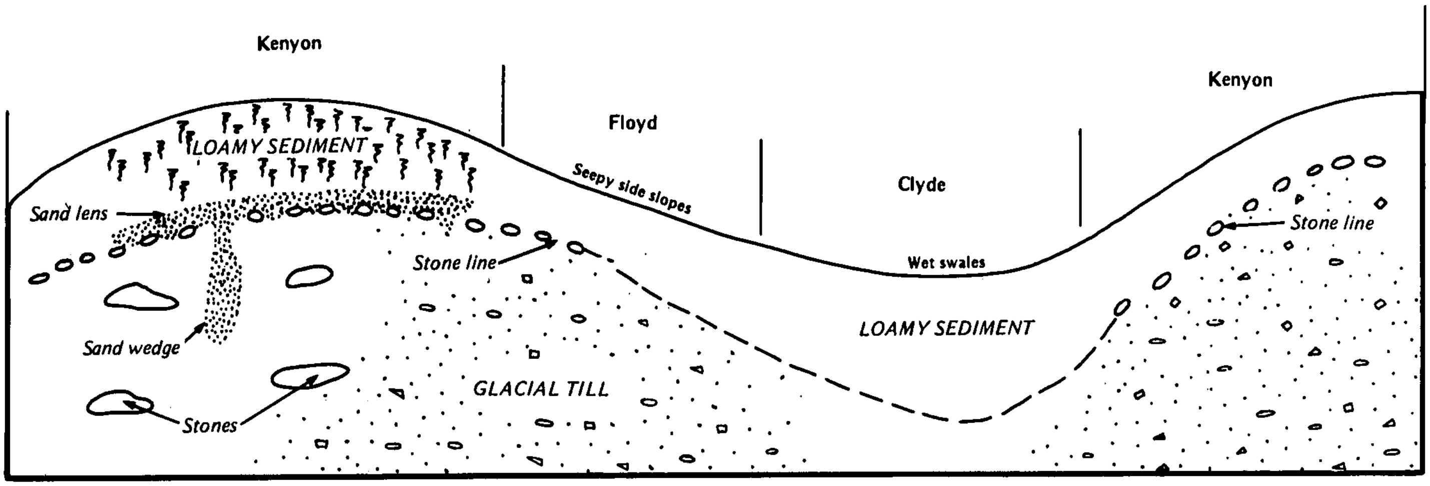


Figure 13.—The parent material of Kenyon, Clyde, and Floyd soils.

loess mantle ranges from less than 4 feet to more than 20 feet in thickness. It overlies glacial till and limestone bedrock.

Downs, Exette, Fayette, and Tama soils formed in silty loess more than 48 inches thick. In some areas they are underlain by limestone, and in other areas they are underlain by glacial till. Dubuque soils formed in 20 to 30 inches of loess and in the underlying material weathered from limestone bedrock. Nordness soils formed in a very thin layer of loess and in the underlying material weathered from limestone bedrock. Dinsdale and Waubeek soils formed in 20 to 40 inches of loess and in the underlying glacial till. Seaton soils formed in coarse-silty loess more than 48 inches deep over glacial till. They are on the pahas that border the Maquoketa River. These phahas are loess-capped elliptical hills that rise above the glacial till plains in Delaware County.

Alluvium is material that has been deposited by rivers and creeks. Alluvial deposits of late Wisconsin age are on the flood plains and terraces in the county. On about 25,000 acres, or 7 percent of the total acreage in the county, the soils formed in this material. The major areas where the soils formed in alluvium are along the Little Turkey and Maquoketa Rivers and along Elk and Buffalo Creeks and their tributaries. Large flood plains are along the Maquoketa River and Buffalo Creek. Several stream terraces 800 to more than 1,000 acres in size also are along these streams. The alluvium along the Little Turkey River and Elk Creek and their tributaries is silty and is low in content of sand. Arenzville, Chaseburg, and Dorchester are among these soils. They washed from loess-covered slopes in the uplands. The alluvium along Buffalo Creek and the Maquoketa River is loamy and consists of lenses and layers of sand, gravel, silt, and clay.

When Buffalo Creek, the Maquoketa River, and other streams overflow their channels and the water spreads over the flood plains, the coarse textured material is deposited first. As the floodwater spreads, it moves more slowly and fine textured sediments, such as silt, are deposited. After the floodwater has receded, the finest material, or clay, settles from the water that is left standing on the lowest part of the flood plain, generally some distance away from the main channel. Recent alluvial soils are near the channel, or within the present meander belt. Spillville-Coland complex, channeled, 0 to 2 percent slopes, is on some sandbars next to the channel. The soils in this complex contain varying amounts of sand, silt, and clay. On bottom land, away from the meander belt, Spillville soils and the soils in the Spillville-Coland complex, 0 to 2 percent slopes, formed. They consist mainly of silt, sand, and some clay.

The soils on alluvial terraces or second and third bottoms are at the higher elevations. They vary in texture. Examples are Flagler, Saude, and Waukee soils, which formed in loamy alluvium underlain by sand and gravel.

Some alluvial material has been transported only a short distance and has accumulated at the foot of the slopes on which it originated. This material, called local alluvium, retains many characteristics of the soils in the areas from whih it has eroded. Clyde and Floyd soils are examples of loamy soils that formed partly in sediments removed from adjacent areas of glacial till on side slopes. Ely and Worthen soils are examples of silty soils that formed in sediments removed from adjacent areas of loess on side slopes.

Textural differences among alluvial deposits are accompanied by some differecnes in the chemical and mineralogical composition. Most alluvial soils in Delaware

County are free of carbonates and are neutral or slightly acid. An exception is Dorchester silt loam, 0 to 2 percent slopes. This soil formed in recent deposits of calcareous alluvium and is moderately alkaline or mildly alkaline.

Eolian sand on uplands and benches is the fourth most extensive parent material in Delaware County. In the glacial till uplands, it occurs as low mounds or dunes and is underlain by till at varying depths. The sand also occurs as areas intermingled with soils that formed in loess. It is mainly quartz, which is very fine and fine in size and highly resistant to weathering. it has not been altered appreciably since it was deposited. Bolan, Chelsea, Dickinson, Lamont, and Sparta soils formed mainly in this material.

Residuum is material weathered in place from sedimentary rocks. Limestone and shale are the types of sedimentary rocks in Delaware County. The residuum commonly is silty clay or clay. That weathered from limestone commonly has a reddish hue, whereas that weathered from shale is more greenish to yellowish. In most areas glacial drift or loess covers the residuum. Soils that formed entirely in residuum are in a few areas. The solum in Goss soils formed mainly in limestone residuum.

In Delaware County the layer of residuum generally is less than 6 inches thick. A deposit of loess overlies a thin layer of limestone residuum in Dubuque and Nordness soils. A layer of loamy material overlies a thin layer of limestone residuum in Backbone, Bertram, Rockton, and Whalan soils. In some areas thin layers of glacial drift are directly above the residuum and are interbedded in the upper part of the residuum.

Organic deposits of plant material accumulated in old lakebeds or swamps that supported a dense stand of water-tolerant plants. The organic soils in this county are in small wet areas where poor drainage has retarded the decay of plant remains. In most areas the organic material ranges from 18 to 50 inches in thickness, but in a few areas it is more than 50 inches thick. Palms soils formed in organic material.

Climate

The soils in Delaware County formed under a midcontinental subhumid climate for at least 5,000 years. Between 5,000 and 16,000 years ago, the climate was conducive to the growth of forest vegetation (*8*). The morphology of most of the soils indicates that the climate under which the soils formed is similar to the present one. The present climate generally is uniform throughout the county but is marked by wide seasonal extremes in temperature. Precipitation is well distributed throughout the year.

Climate is a major factor in determining the characteristics of the soils. It affects the rate and intensity of hydrolysis, carbonation, oxidation, and other important chemical reactions. Temperature, rainfall, relative humidity, and length of the frost-free period are important in determining the kind of vegetation on the soil.

The influence of the general climate of the region is somewhat modified by local conditions. For example, soils on south-facing slopes formed under a microclimate that is warmer and drier than that of the soils in nearby areas. Also, low lying, poorly drained soils formed under a microclimate that is wetter and colder than that of most of the surrounding soils. These local conditions account for some of the differences among the soils in the county.

Plant and Animal Life

Plant and animal life is an important factor in soil formation. Plants are especially significant. Soil formation really begins with the growth of vegetation. As plants grow and die, they add organic matter to the upper layers of soil material. The native grasses have myriads of fibrous roots that penetrate the soil to a depth of 10 to 20 inches and add large amounts of organic matter to the surface layer. Trees commonly feed on plant nutrients deep in the subsoil; consequently, they add little organic matter to the surface layer other than that gained from falling leaves and dead trees. Much of the organic matter from dead trees remains on the surface or is lost through decomposition.

Soils that formed under forest vegetation have a dark surface layer that generally is less than 5 inches thick. They have a lighter colored E horizon directly below the surface layer. In contrast, soils that formed under prairie grasses contain a large amount of organic matter derived from roots and have a thick, dark surface layer. Kenyon and Tama are typical of the soils that formed under prairie grasses. Clyde and Ossian are typical of the soils that formed under prairie grasses and water-tolerant plants. Dubuque, Fayette, and Coggon are typical of the soils that formed under forest vegetation. Bassett, Downs, and Oran soils have properties intermediate between those of the soils that formed entirely under prairie grasses and the soils that formed entirely under forest vegetation.

Downs, Fayette, and Tama soils are members of a biosequence, or a group of soils that formed in the same kind of parent material and under a comparable environment, except for the native vegetation. The native vegetation has caused the main morphological differences among these soils.

The activities of burrowing animals and insects have helped to loosen and aerate the upper few feet of the soils.

Relief

Relief, or topography, is an important cause of differences among soils. It indirectly influences soil formation through its effect on drainage. The relief in Delaware County ranges from level to very steep. Many nearly level soils are frequently flooded and have a seasonal high water table. Water soaks into the nearly level soils that are not flooded. Much of the rainfall runs off the more sloping areas, and less penetrates the surface.

Clyde, Colo, and Marshan soils, which have a seasonal high water table, generally have an olive gray subsoil. Soils that formed in areas where the water table was below the subsoil have a yellowish brown subsoil. Examples are Dinsdale, Downs, Kenyon, and Tama soils. Floyd, Lawler, Muscatine, Oran, and other somewhat poorly drained soils have a grayish brown, mottled subsoil. Of the soils that formed under prairie grasses, those that have a higher water table generally have more organic matter in the surface layer than the better drained soils.

Downs, Fayette, and Seaton soils, which have wide slope ranges, have some properties that change as the slope increases. Two of these properties are the depth to carbonates and the thickness of the surface layer. The carbonates are closest to the surface in areas where slopes are steepest. The surface layer becomes thinner as the slope increases. Other properties that change as slope increases are the maximum clay content in the B horizon and the depth to the layer that has the maximum clay content. Both of these decrease with increasing slope (*3, 5*).

Aspect, as well as gradient, has a significant effect on soil formation. South-facing slopes, for example, generally are warmer and drier than north-facing slopes and consequently support a different kind and amount of vegetation.

The nearly level Lawler, Marshan, and Saude soils are examples of soils that formed in the same kind of parent material and under similar vegetation but that differ because of slight differences in topographic position. Their microrelief affects runoff and the depth to the water table. Marshan soils, which are in low areas on stream terraces, have a seasonal high water table and impound water for short periods. Lawler soils, which are in the slightly higher areas on the terraces, are somewhat poorly drained. Saude soils, which are in the higher areas on the terraces, are well drained.

Topography also has affected the formation of Worthen and Nordness soils. Worthen soils are on foot slopes and in some upland drainageways. They have properties related to the higher lying soils from which they receive sediments. In many areas Nordness soils are steep or very steep and show very little evidence of soil formation. Most of the rainfall in these areas runs off the surface and thus does not enter the soils.

The influence of a porous, rapidly permeable parent material can override the influence of topography. Flagler soils, for example, are somewhat excessively drained, even though they are no more than gently sloping, because they are moderately rapidly permeable in the subsoil and very rapidly permeable in the substratum.

Time

Time is necessary for the various processes of soil formation to take place. The amount of time necessary for the formation of the subsoil in many of the older upland soils can be as much as a thousand years or more. Older or more strongly developed soils have well defined genetic horizons. Kenyon and Tama soils are examples. A less well developed soil has only weakly expressed horizons. Some of the soils that formed in alluvium show little or no evidence of profile development because the alluvial material is recently deposited and has not been in place long enough for the formation of well defined genetic horizons.

If other factors are favorable, the texture of the subsoil generally becomes finer and a greater amount of soluble material is leached out as the soils continue to weather. Exceptions are soils that formed in quartz sand, such as Sparta soils, or in other material that is resistant to weathering. These soils do not change much over long periods. Other exceptions are steep or very steep soils, such as Nordness. Much of the rainfall runs off the surface of these soils. As a result, the soils weather more slowly than soils in stable, less sloping areas. These exceptions indicate that the age of the parent material does not necessarily reflect the maturity of the soil that formed in that material.

Where organic material, such as trees, has been buried by later deposition through the action of ice, water, or wind, the age of a landscape can be determined by a process known as radiocarbon dating. The loess in which the Downs, Fayette, and Tama soils in this county formed is probably about 14,000 to 20,000 years old. Recent studies show that the Iowan erosion surface formed during the time of loess deposition. Radiocarbon dates indicate that this period was 14,000 to 20,000 years ago. In areas where it is covered by loamy surficial sediments, the Iowan surface is less than 14,000 years old (*10*). The soils on the slopes are probably much younger. Bassett, Kenyon, and Coggon soils are on this surface. Clyde and Floyd soils are younger because they are cut in and below these higher lying soils.

Human Activities

Important changes in the soils took place when Delaware County was settled. Some had little effect on soil productivity; others had drastic effects. Breaking the prairie sod and clearing the timber removed and changed the protective cover.

Changes caused by water erosion are the most apparent. Cultivation changes the soil by making the sloping areas more susceptible to erosion, which removes the topsoil, organic matter, and plant nutrients. Sheet erosion, which is prevalent in this county, removes a few inches of topsoil at a time, but cultivation generally destroys all evidence of this loss. In some areas, shallow and deep gullies have formed and the eroded material has been deposited on the lower slopes. As the land was brought under cultivation, the runoff rate increased and the rate at which water moves into the soil decreased. As a result, accelerated erosion has removed part or all of the original surface layer from many of the more sloping soils. Examples are the moderately eroded Bassett, Downs, Fayette, and Kenyon soils.

Erosion is the main cause of the loss of organic matter in soils, but as much as one-third of the organic matter can be lost through causes other than erosion (*13*). Maintaining as high a reserve of organic matter as was originally present under native grasses is not economically feasible. Measures that maintain a safe and economical level for crops, however, are needed. In soils lowest in organic matter content, the level is maintained by control of erosion.

Soil blowing also occurs after the soil is cultivated. Light textured soils are highly susceptible to soil blowing, especially if the surface is bare and the topsoil is dry. After nearly level fields are plowed in the fall, dark topsoil is mixed with snow or piled along fence rows and road ditches.

In fields that are cultivated year after year, the well developed granular structure of the surface layer, so apparent in virgin grassland, begins to break down. The surface layer generally is baked and hard when dry. The fine textured soils that are plowed when wet tend to puddle and are less permeable than similar soils in uncultivated areas. In some fields of finer textured soils, a compact layer forms below the plow layer. The compact layer hardens when it dries and is less permeable than the subsoil. It is called a plowsole or plowpan.

Management practices have increased the productivity of some soils and reclaimed areas that otherwise are not suitable for crops. Crops can be grown, for example, in areas where drainage ditches and diversions at the foot of slopes help to prevent flooding on bottom land. Drainage tile has reduced the wetness of some soils, and terraces have provided protection against erosion. Applications of commercial fertilizer and lime have corrected deficiencies in plant nutrients, so that many soils are more productive now than they were in their natural state.

Processes of Horizon Differentiation

Horizon differentiation is considered to be caused by four basic kinds of change. These are additions, removals, transfers, and transformations in the soil (*12*). Each of these changes affects many substances in the soil, including organic matter, soluble salts, carbonates, sesquioxides, and silicate clay minerals. In general, these processes tend to promote horizon differentiation, but some tend to offset or retard it. The processes and the changes brought about by them occur simultaneously in the soil, and the ultimate nature of the soil is governed by the balance of these changes within the profile.

An accumulation of organic matter is an early step in the differentiation of horizons in most soils. The soils in Delaware County range from very high to very low in the amount of organic matter that has accumulated in the A horizon. Fayette soils, for example, have a thin A horizon that is low in organic matter content. Spillville and Worthen are among the soils that have a thick A horizon in which the content of organic matter is very high. Some soils that were formerly quite high in organic matter content are now low because of erosion.

The removal of substances from parts of the soil profile is important in the differentiation of horizons in the soils in Delaware County. The downward movement of calcium carbonates and bases is an example. All the soils in the county, except for Dorchester soils, have been leached of calcium carbonates in the upper part, and some have been so strongly leached that they are strongly acid or very strongly acid in the subsoil.

A number of substances are transferred from one horizon to another in the soils in the county. For example, phosphorus is removed from the subsoil by plant roots and transferred to the parts of the plant growing above the ground. It is then added to the surface layer in the plant residue. This process affects the form and distribution of phosphorus in the soil.

The translocation of silicate clay minerals has an important effect on horizon differentiation. The clay minerals are carried downward in suspension in percolating water from the A horizon. They accumulate in the B horizon in pores and root channels and as clay films on the faces of peds. In Delaware County this process has affected the profile of many soils. In other soils, however, the clay content of the A horizon is not markedly different from that of the B horizon and other evidence of clay movement is minimal.

Transformations are physical and chemical. The weathering of soil particles to smaller sizes is an example of a transformation. The reduction of iron is another example. This process is called gleying. It occurs when the soil is saturated for long periods. The soil contains enough organic matter for biological activity to take place during the periods of saturation. Gleying is evidenced by ferrous iron and gray colors in the soil. It is a characteristic of poorly drained soils, such as Ossian and Clyde soils. Reductive extractable iron, or free iron, generally is not so evident in somewhat poorly drained soils, such as Floyd and Lawler soils.

Another kind of transformation is the weathering of the primary apatite mineral in the parent material to secondary phosphorus compounds. This transformation tends to occur in soils that have a pH near 7. Thus, soils that have a pH of more than 7, such as Dorchester soils, have a lower supply of available phosphorus than soils that have a pH near 7, such as Clyde soils.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce 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.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

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; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

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

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Paha. A prominent, loess-covered, elongated ridge or elliptical, moundlike hill oriented in a northwest-southeast direction on the Iowan erosion surface.

Paleosol. A buried or formerly buried soil, especially one that formed during an interglacial period and was later covered by glacial deposits.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Data were recorded in the period 1951-75 at Delaware, Iowa)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	24.9	6.1	15.5	49	-24	0	1.07	0.32	1.67	3	6.8
February---	30.5	11.1	20.8	52	-20	0	1.07	.31	1.67	4	6.9
March------	40.4	21.5	31.0	73	- 6	11	2.36	1.24	3.33	6	8.9
April------	57.5	35.2	46.4	84	13	53	3.58	2.27	4.76	7	1.4
May--------	69.6	46.6	58.1	91	27	272	4.64	2.72	6.34	9	.1
June-------	79.0	56.1	67.6	94	39	528	4.92	3.01	6.62	8	.0
July-------	82.9	59.9	71.4	96	44	663	4.23	2.20	6.00	7	.0
August-----	81.3	58.0	69.7	94	42	611	3.89	1.74	5.72	7	.0
September--	73.0	49.0	61.0	92	30	333	3.81	1.47	5.76	6	.0
October----	63.0	38.8	50.9	87	19	150	2.49	.61	3.99	5	.1
November---	45.0	26.1	35.6	71	2	0	1.89	.78	2.82	4	2.3
December---	31.2	13.8	22.5	59	-21	0	1.50	.75	2.15	4	6.7
Yearly:											
Average--	56.5	35.2	45.9	---	---	---	---	---	---	---	---
Extreme--	---	---	---	97	-25	---	---	---	---	---	---
Total----	---	---	---	---	---	2,621	35.45	28.92	41.63	70	33.2

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Data were recorded in the period 1951-75 at Delaware, Iowa)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 28	May 8	May 23
2 years in 10 later than--	April 23	May 4	May 18
5 years in 10 later than--	April 14	April 25	May 9
First freezing temperature in fall:			
1 year in 10 earlier than--	October 9	September 26	September 23
2 years in 10 earlier than--	October 14	October 2	September 27
5 years in 10 earlier than--	October 24	October 11	October 4

TABLE 3.--GROWING SEASON

(Data were recorded in the period 1951-75 at Delaware, Iowa)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	170	149	132
8 years in 10	178	156	137
5 years in 10	192	168	148
2 years in 10	205	181	158
1 year in 10	213	187	163

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
11B	Colo-Ely complex, 2 to 5 percent slopes	7,530	2.1
41	Sparta loamy fine sand, 0 to 2 percent slopes	390	0.1
41B	Sparta loamy fine sand, 2 to 5 percent slopes	5,170	1.4
41C	Sparta loamy fine sand, 5 to 9 percent slopes	1,670	0.5
63B	Chelsea loamy fine sand, 2 to 5 percent slopes	1,720	0.5
63C	Chelsea loamy fine sand, 5 to 9 percent slopes	3,480	0.9
63D	Chelsea loamy fine sand, 9 to 14 percent slopes	1,790	0.5
63E	Chelsea loamy fine sand, 14 to 18 percent slopes	1,180	0.3
65D2	Lindley loam, 9 to 14 percent slopes, moderately eroded	260	0.1
65E3	Lindley clay loam, 14 to 18 percent slopes, severely eroded	420	0.1
83B	Kenyon loam, 2 to 5 percent slopes	53,670	14.4
83C	Kenyon loam, 5 to 9 percent slopes	1,380	0.4
83C2	Kenyon loam, 5 to 9 percent slopes, moderately eroded	740	0.2
84	Clyde clay loam, 0 to 3 percent slopes	850	0.2
109B	Backbone fine sandy loam, 2 to 5 percent slopes	2,220	0.6
109C	Backbone fine sandy loam, 5 to 9 percent slopes	2,970	0.8
110B	Lamont fine sandy loam, 2 to 5 percent slopes	1,530	0.4
110C	Lamont fine sandy loam, 5 to 9 percent slopes	1,420	0.4
119	Muscatine silt loam, 1 to 3 percent slopes	650	0.2
120B	Tama silt loam, 2 to 5 percent slopes	5,430	1.5
120C	Tama silt loam, 5 to 9 percent slopes	1,270	0.3
129B	Arenzville-Chaseburg silt loams, 2 to 5 percent slopes	3,160	0.9
133+	Colo silt loam, overwash, 0 to 2 percent slopes	530	0.1
151	Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	1,080	0.3
152	Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	3,890	1.1
153	Marshan silty clay loam, depressional, 0 to 1 percent slopes	220	0.1
158	Dorchester silt loam, 0 to 2 percent slopes	460	0.1
159	Finchford loamy sand, 0 to 2 percent slopes	340	0.1
159C	Finchford loamy sand, 2 to 9 percent slopes	290	0.1
162B	Downs silt loam, 2 to 5 percent slopes	2,000	0.5
162C	Downs silt loam, 5 to 9 percent slopes	2,480	0.7
162C2	Downs silt loam, 5 to 9 percent slopes, moderately eroded	5,890	1.6
162D	Downs silt loam, 9 to 14 percent slopes	280	0.1
162D2	Downs silt loam, 9 to 14 percent slopes, moderately eroded	5,840	1.6
163C	Fayette silt loam, 5 to 9 percent slopes	990	0.3
163C2	Fayette silt loam, 5 to 9 percent slopes, moderately eroded	2,080	0.6
163D	Fayette silt loam, 9 to 14 percent slopes	1,630	0.4
163D2	Fayette silt loam, 9 to 14 percent slopes, moderately eroded	14,240	3.9
163D3	Fayette silty clay loam, 9 to 14 percent slopes, severely eroded	570	0.2
163E	Fayette silt loam, 14 to 18 percent slopes	2,080	0.6
163E2	Fayette silt loam, 14 to 18 percent slopes, moderately eroded	11,650	3.1
163E3	Fayette silty clay loam, 14 to 18 percent slopes, severely eroded	970	0.3
163F	Fayette silt loam, 18 to 25 percent slopes	3,700	1.0
163F2	Fayette silt loam, 18 to 25 percent slopes, moderately eroded	3,120	0.9
163F3	Fayette silty clay loam, 18 to 25 percent slopes, severely eroded	650	0.2
163G	Fayette silt loam, 25 to 40 percent slopes	2,940	0.8
171B	Bassett loam, 2 to 5 percent slopes	6,030	1.6
171C2	Bassett loam, 5 to 9 percent slopes, moderately eroded	1,080	0.3
174B	Bolan loam, 2 to 5 percent slopes	2,320	0.6
174C	Bolan loam, 5 to 9 percent slopes	670	0.2
175	Dickinson fine sandy loam, 0 to 2 percent slopes	250	0.1
175B	Dickinson fine sandy loam, 2 to 5 percent slopes	4,690	1.3
175C	Dickinson fine sandy loam, 5 to 9 percent slopes	1,020	0.3
177	Saude loam, 0 to 2 percent slopes	5,650	1.5
177B	Saude loam, 2 to 5 percent slopes	860	0.2
178	Waukee loam, 0 to 2 percent slopes	1,110	0.3
178B	Waukee loam, 2 to 5 percent slopes	160	*
183C	Dubuque silt loam, 20 to 30 inches to limestone, 5 to 9 percent slopes	450	0.1
183E	Dubuque silt loam, 20 to 30 inches to limestone, 14 to 18 percent slopes	620	0.2
198B	Floyd loam, 1 to 4 percent slopes	2,960	0.8
205B	Whalan loam, 30 to 40 inches to limestone, 2 to 5 percent slopes	530	0.1
207B	Whalan loam, 20 to 30 inches to limestone, 2 to 5 percent slopes	750	0.2
207C	Whalan loam, 20 to 30 inches to limestone, 5 to 9 percent slopes	400	0.1
213B	Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes	1,570	0.4

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
214B	Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes	2,120	0.6
215C	Goss loam, 2 to 9 percent slopes	1,880	0.5
221	Palms muck, 1 to 4 percent slopes	420	0.1
225	Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	2,850	0.8
226	Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	1,320	0.4
241B	Burkhardt-Saude complex, 2 to 5 percent slopes	2,200	0.6
284	Flagler fine sandy loam, 0 to 2 percent slopes	1,600	0.4
284B	Flagler fine sandy loam, 2 to 5 percent slopes	970	0.3
285B	Burkhardt sandy loam, 2 to 5 percent slopes	380	0.1
302B	Coggon loam, 2 to 5 percent slopes	580	0.2
323B	Terril loam, sandy substratum, 2 to 5 percent slopes	1,110	0.3
353B	Tell silt loam, 2 to 5 percent slopes	280	0.1
377B	Dinsdale silt loam, 2 to 5 percent slopes	9,070	2.5
377C	Dinsdale silt loam, 5 to 9 percent slopes	1,000	0.3
377C2	Dinsdale silt loam, 5 to 9 percent slopes, moderately eroded	780	0.2
391B	Clyde-Floyd complex, 1 to 4 percent slopes	62,700	17.0
399	Readlyn loam, 1 to 3 percent slopes	1,940	0.5
407B	Schley loam, 1 to 4 percent slopes	1,400	0.4
408B	Olin fine sandy loam, 2 to 5 percent slopes	6,420	1.8
408C	Olin fine sandy loam, 5 to 9 percent slopes	1,010	0.3
412C	Sogn loam, 2 to 9 percent slopes	2,650	0.7
426B	Aredale silt loam, 2 to 5 percent slopes	1,680	0.5
426C	Aredale silt loam, 5 to 9 percent slopes	560	0.2
428B	Ely silty clay loam, 2 to 5 percent slopes	850	0.2
468B	Olin Variant sandy loam, 2 to 5 percent slopes	580	0.2
468C	Olin Variant sandy loam, 5 to 9 percent slopes	550	0.1
471	Oran loam, 1 to 3 percent slopes	480	0.1
478G	Nordness-Rock outcrop complex, 25 to 60 percent slopes	4,720	1.3
485	Spillville loam, 0 to 2 percent slopes	730	0.2
488C2	Newvienna silt loam, 5 to 9 percent slopes, moderately eroded	960	0.3
488D2	Newvienna silt loam, 9 to 14 percent slopes, moderately eroded	420	0.1
489	Ossian silt loam, 0 to 2 percent slopes	1,770	0.5
499B	Nordness silt loam, 2 to 5 percent slopes	410	0.1
499D	Nordness silt loam, 5 to 14 percent slopes	6,390	1.7
499F	Nordness silt loam, 14 to 25 percent slopes	3,290	0.9
585	Spillville-Coland complex, 0 to 2 percent slopes	2,210	0.6
663D2	Seaton silt loam, 9 to 14 percent slopes, moderately eroded	1,700	0.5
663E2	Seaton silt loam, 14 to 18 percent slopes, moderately eroded	1,160	0.3
663E3	Seaton silt loam, 14 to 18 percent slopes, severely eroded	530	0.1
725	Hayfield loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	1,100	0.3
763E2	Exette silt loam, 14 to 18 percent slopes, moderately eroded	710	0.2
763F2	Exette silt loam, 18 to 25 percent slopes, moderately eroded	540	0.1
771B	Waubeek silt loam, 2 to 5 percent slopes	680	0.2
771C	Waubeek silt loam, 5 to 9 percent slopes	470	0.1
776	Lilah sandy loam, 0 to 2 percent slopes	1,050	0.3
776C	Lilah sandy loam, 2 to 9 percent slopes	2,420	0.7
777	Wapsie loam, 0 to 2 percent slopes	750	0.2
781B	Lourdes loam, 2 to 5 percent slopes	490	0.1
782B	Donnan loam, 2 to 6 percent slopes	920	0.3
793	Bertrand silt loam, 0 to 2 percent slopes	970	0.3
798B	Protivin loam, 1 to 4 percent slopes	470	0.1
809B	Bertram fine sandy loam, 2 to 5 percent slopes	650	0.2
809C	Bertram fine sandy loam, 5 to 9 percent slopes	310	0.1
826	Rowley silt loam, 0 to 2 percent slopes	1,100	0.3
883B	Cresken clay loam, 2 to 5 percent slopes	3,560	1.0
907B	Schley loam, sandy substratum, 2 to 5 percent slopes	460	0.1
933B	Sawmill silty clay loam, 1 to 4 percent slopes	7,210	2.0
977	Richwood silt loam, 0 to 2 percent slopes	490	0.1
981	Worthen silt loam, 0 to 2 percent slopes	500	0.1
981B	Worthen silt loam, 2 to 5 percent slopes	1,590	0.4
1485	Spillville loam, channeled, 0 to 2 percent slopes	2,910	0.8
1585	Spillville-Coland complex, channeled, 0 to 2 percent slopes	5,890	1.6
5010	Pits, sand and gravel	220	0.1
5030	Pits, limestone quarries	380	0.1

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
5040	Orthents, loamy	240	0.1
5042	Udorthents, gravelly	90	*
	Water	940	0.3
	Total	366,720	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
11B	Colo-Ely complex, 2 to 5 percent slopes (where drained)
83B	Kenyon loam, 2 to 5 percent slopes
84	Clyde clay loam, 0 to 3 percent slopes (where drained)
110B	Lamont fine sandy loam, 2 to 5 percent slopes
119	Muscatine silt loam, 1 to 3 percent slopes
120B	Tama silt loam, 2 to 5 percent slopes
129B	Arenzville-Chaseburg silt loams, 2 to 5 percent slopes
133+	Colo silt loam, overwash, 0 to 2 percent slopes (where drained)
151	Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes (where drained)
152	Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes (where drained)
158	Dorchester silt loam, 0 to 2 percent slopes (where protected from flooding or not frequently flooded during the growing season)
162B	Downs silt loam, 2 to 5 percent slopes
171B	Bassett loam, 2 to 5 percent slopes
174B	Bolan loam, 2 to 5 percent slopes
175	Dickinson fine sandy loam, 0 to 2 percent slopes
175B	Dickinson fine sandy loam, 2 to 5 percent slopes
177	Saude loam, 0 to 2 percent slopes
177B	Saude loam, 2 to 5 percent slopes
178	Waukee loam, 0 to 2 percent slopes
178B	Waukee loam, 2 to 5 percent slopes
198B	Floyd loam, 1 to 4 percent slopes
205B	Whalan loam, 30 to 40 inches to limestone, 2 to 5 percent slopes
207B	Whalan loam, 20 to 30 inches to limestone, 2 to 5 percent slopes
213B	Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes
214B	Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes
225	Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
226	Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
302B	Coggon loam, 2 to 5 percent slopes
323B	Terril loam, sandy substratum, 2 to 5 percent slopes
353B	Tell silt loam, 2 to 5 percent slopes
377B	Dinsdale silt loam, 2 to 5 percent slopes
391B	Clyde-Floyd complex, 1 to 4 percent slopes (where drained)
399	Readlyn loam, 1 to 3 percent slopes
407B	Schley loam, 1 to 4 percent slopes (where drained)
408B	Olin fine sandy loam, 2 to 5 percent slopes
426B	Aredale silt loam, 2 to 5 percent slopes
428B	Ely silty clay loam, 2 to 5 percent slopes
468B	Olin Variant sandy loam, 2 to 5 percent slopes
471	Oran loam, 1 to 3 percent slopes
485	Spillville loam, 0 to 2 percent slopes
489	Ossian silt loam, 0 to 2 percent slopes (where drained)
585	Spillville-Coland complex, 0 to 2 percent slopes (where drained)
725	Hayfield loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
771B	Waubeek silt loam, 2 to 5 percent slopes
777	Wapsie loam, 0 to 2 percent slopes
781B	Lourdes loam, 2 to 5 percent slopes
782B	Donnan loam, 2 to 6 percent slopes
793	Bertrand silt loam, 0 to 2 percent slopes
798B	Protivin loam, 1 to 4 percent slopes
826	Rowley silt loam, 0 to 2 percent slopes
883B	Cresken clay loam, 2 to 5 percent slopes
907B	Schley loam, sandy substratum, 2 to 5 percent slopes (where drained)
933B	Sawmill silty clay loam, 1 to 4 percent slopes (where drained)
977	Richwood silt loam, 0 to 2 percent slopes
981	Worthen silt loam, 0 to 2 percent slopes
981B	Worthen silt loam, 2 to 5 percent slopes

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
11B------------- Colo-Ely	IIw	146	48	93	4.6	4.1	6.4	7.6
41-------------- Sparta	IVs	80	24	48	3.4	1.1	2.1	2.4
41B------------- Sparta	IVs	77	23	46	3.2	1.0	2.1	2.4
41C------------- Sparta	IVs	72	22	43	3.0	0.7	0.8	1.0
63B------------- Chelsea	IVs	68	21	41	2.8	2.0	3.3	3.3
63C------------- Chelsea	IVs	63	19	38	2.7	1.8	3.0	3.0
63D------------- Chelsea	VIs	---	---	---	2.3	1.5	2.5	2.5
63E------------- Chelsea	VIIs	---	---	---	1.6	1.1	2.1	2.1
65D2------------ Lindley	IVe	97	32	45	4.0	1.3	5.8	6.6
65E3------------ Lindley	VIIe	---	---	---	3.0	1.1	2.0	2.2
83B------------- Kenyon	IIe	154	47	92	6.5	4.2	6.6	7.8
83C------------- Kenyon	IIIe	149	45	89	6.3	4.0	6.5	7.5
83C2------------ Kenyon	IIIe	145	44	87	6.1	3.8	6.3	7.3
84-------------- Clyde	IIw	140	43	84	4.2	6.6	5.5	6.6
109B------------ Backbone	IVs	52	16	31	2.2	2.3	3.8	4.5
109C------------ Backbone	IVs	47	14	28	2.1	2.0	3.0	3.5
110B------------ Lamont	IIIe	91	28	55	3.9	2.3	3.5	4.1
110C------------ Lamont	IIIe	86	26	52	3.7	2.1	3.3	3.8
119------------- Muscatine	I	170	56	102	6.8	4.2	7.6	9.1
120B------------ Tama	IIe	167	56	100	7.0	4.2	7.5	8.6

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
120C------------ Tama	IIIe	162	54	97	6.8	4.0	7.1	8.3
129B------------ Arenzville-Chaseburg	IIe	130	44	80	5.5	4.9	5.4	5.7
133+------------ Colo	IIw	140	47	92	4.3	4.2	5.8	7.0
151------------- Marshan	IIw	112	35	70	3.4	3.3	5.0	6.0
152------------- Marshan	IIw	126	38	76	3.4	3.3	5.0	6.0
153------------- Marshan	IIIw	96	31	58	2.9	2.7	4.5	5.0
158------------- Dorchester	IIw	136	43	82	5.7	3.8	5.6	6.6
159------------- Finchford	IVs	54	16	32	2.2	1.5	2.0	2.5
159C------------ Finchford	IVs	46	14	28	1.9	1.3	1.6	2.0
162B------------ Downs	IIe	158	53	95	6.6	4.1	7.1	8.3
162C------------ Downs	IIIe	153	51	92	6.4	4.0	6.8	8.1
162C2----------- Downs	IIIe	149	50	89	6.3	3.8	6.6	7.8
162D------------ Downs	IIIe	144	48	86	6.1	3.8	6.3	7.3
162D2----------- Downs	IIIe	140	47	84	5.9	3.6	6.1	7.1
163C------------ Fayette	IIIe	144	48	86	6.1	3.8	6.5	7.5
163C2----------- Fayette	IIIe	140	47	84	5.9	3.6	6.5	7.5
163D------------ Fayette	IIIe	135	45	81	5.7	3.6	6.0	7.0
163D2----------- Fayette	IIIe	131	44	79	5.5	3.5	5.8	6.6
163D3----------- Fayette	IVe	123	41	74	5.2	3.5	5.3	6.3
163E------------ Fayette	IVe	118	40	71	5.0	3.3	5.0	5.8
163E2----------- Fayette	IVe	114	38	68	4.8	3.2	4.8	5.6

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
163E3----------- Fayette	VIe	---	---	---	4.5	3.0	4.5	5.3
163F------------ Fayette	VIe	---	---	---	4.7	3.1	4.8	5.6
163F2----------- Fayette	VIe	---	---	---	4.5	2.8	4.5	5.0
163F3----------- Fayette	VIe	---	---	---	4.3	2.5	4.2	4.6
163G------------ Fayette	VIIe	---	---	---	4.3	3.0	4.2	5.0
171B------------ Bassett	IIe	145	44	87	6.1	4.0	6.5	7.5
171C2----------- Bassett	IIIe	136	41	82	5.7	3.5	6.0	6.6
174B------------ Bolan	IIe	138	46	73	5.8	3.6	5.2	6.1
174C------------ Bolan	IIIe	133	45	70	5.6	3.3	4.8	5.8
175------------- Dickinson	IIs	112	34	67	4.7	2.7	5.0	5.0
175B------------ Dickinson	IIe	109	33	65	4.6	2.7	4.8	5.0
175C------------ Dickinson	IIIe	104	32	62	4.4	2.5	4.5	4.6
177------------- Saude	IIs	107	33	64	4.5	3.0	4.6	5.5
177B------------ Saude	IIe	104	32	62	4.4	3.0	4.5	5.3
178------------- Waukee	IIs	132	40	79	5.5	4.0	5.8	6.8
178B------------ Waukee	IIe	129	39	77	5.4	4.0	5.6	6.6
183C------------ Dubuque	IIIe	94	31	56	4.0	2.4	4.0	4.6
183E------------ Dubuque	VIe	---	---	41	2.9	1.6	3.0	3.5
198B------------ Floyd	IIw	144	44	84	5.8	4.1	6.9	7.5
205B------------ Whalan	IIe	111	34	67	4.7	4.5	4.9	4.0
207B------------ Whalan	IIe	84	28	52	3.5	3.3	4.6	2.7

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
207C------------ Whalan	IIIe	79	26	49	3.4	3.0	4.3	2.5
213B------------ Rockton	IIe	129	36	77	5.4	3.6	4.6	6.6
214B------------ Rockton	IIe	104	29	60	4.4	2.6	4.1	5.0
215C------------ Goss	IVs	62	19	37	3.0	2.7	4.7	4.7
221------------- Palms	IIIw	95	30	55	3.5	2.6	4.6	4.6
225------------- Lawler	IIs	119	36	71	4.8	3.7	5.0	6.0
226------------- Lawler	IIs	138	42	83	5.5	4.0	6.0	7.0
241B------------ Burkhardt-Saude	IVs	72	22	43	3.0	2.1	3.8	4.4
284------------- Flagler	IIIs	87	27	52	3.7	2.3	4.3	5.0
284B------------ Flagler	IIIe	84	26	50	3.5	2.1	4.1	4.8
285B------------ Burkhardt	IVs	49	15	29	2.1	1.4	2.4	2.8
302B------------ Coggon	IIe	136	41	82	5.7	3.8	6.0	7.1
323B------------ Terril	IIe	134	41	80	5.6	4.2	7.0	8.3
353B------------ Tell	IIe	124	42	75	5.2	3.6	5.8	7.0
377B------------ Dinsdale	IIe	160	54	96	6.7	4.1	7.1	8.3
377C------------ Dinsdale	IIIe	155	52	93	6.5	4.0	6.8	8.0
377C2----------- Dinsdale	IIIe	151	51	91	6.3	3.8	6.6	7.6
391B------------ Clyde-Floyd	IIw	142	43	84	4.2	5.6	6.0	7.0
399------------- Readlyn	I	157	47	92	6.3	4.1	6.8	7.8
407B------------ Schley	IIw	130	40	76	5.2	4.0	6.0	7.0
408B------------ Olin	IIe	133	41	80	5.6	3.0	5.8	6.8

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
408C------------ Olin	IIIe	128	39	77	5.4	2.8	5.5	6.5
412C------------ Sogn	VIIs	---	---	---	2.6	0.7	0.8	1.0
426B------------ Aredale	IIe	149	45	89	6.3	4.2	6.8	7.8
426C------------ Aredale	IIIe	144	44	86	6.1	4.0	6.5	7.5
428B------------ Ely	IIe	159	53	95	6.4	4.0	7.5	8.8
468B------------ Olin Variant	IIe	123	38	74	5.2	2.9	5.6	6.5
468C------------ Olin Variant	IIIe	118	36	71	5.0	2.7	5.3	6.3
471------------- Oran	I	145	44	87	5.9	3.8	6.3	7.5
478G------------ Nordness-Rock outcrop	VIIs	---	---	---	---	---	---	---
485------------- Spillville	IIw	156	48	94	6.2	4.2	7.3	8.6
488C2----------- Newvienna	IIIe	142	48	85	6.0	3.6	6.7	7.7
488D2----------- Newvienna	IIIe	133	46	82	5.6	3.1	6.0	7.0
489------------- Ossian	IIw	140	47	84	4.2	4.1	6.6	7.6
499B------------ Nordness	IVs	48	15	29	2.0	1.5	2.0	2.5
499D------------ Nordness	VIs	---	---	20	1.2	1.0	1.2	2.0
499F------------ Nordness	VIIs	---	---	---	0.5	0.7	0.8	0.8
585------------- Spillville-Coland	IIw	147	46	88	4.4	4.2	6.7	8.1
663D2----------- Seaton	IIIe	131	44	79	5.5	3.8	5.3	7.1
663E2----------- Seaton	IVe	114	38	68	4.8	4.0	5.5	6.9
663E3----------- Seaton	VIe	---	---	---	4.5	3.6	5.3	6.9

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
725----------- Hayfield	IIs	110	34	66	4.4	3.0	5.0	5.0
763E2---------- Exette	IVe	109	37	65	4.6	2.5	4.5	5.3
763F2---------- Exette	VIe	---	---	55	4.2	2.0	2.9	4.6
771B----------- Waubeek	IIe	151	51	91	6.3	4.0	6.8	7.8
771C----------- Waubeek	IIIe	146	49	88	6.1	3.8	6.5	7.5
776------------ Lilah	IVs	51	16	31	2.1	1.3	1.0	2.6
776C----------- Lilah	IVs	43	13	26	1.8	1.0	1.2	2.1
777------------ Wapsie	IIs	95	29	57	4.0	2.7	4.3	5.0
781B----------- Lourdes	IIe	118	36	73	5.0	3.3	5.0	5.6
782B----------- Donnan	IIe	92	28	55	3.7	2.7	3.5	4.6
793------------ Bertrand	I	144	48	86	6.1	4.2	6.7	8.1
798B----------- Protivin	IIw	123	38	74	5.0	3.6	5.3	6.1
809B----------- Bertram	IVs	57	18	34	2.2	2.5	3.6	4.5
809C----------- Bertram	IVs	52	16	31	2.2	2.3	3.0	3.5
826------------ Rowley	IIw	162	54	97	6.5	4.6	6.9	8.3
883B----------- Cresken	IIe	140	43	84	5.9	4.0	6.3	7.4
907B----------- Schley	IIw	111	34	66	4.2	4.0	6.0	7.0
933B----------- Sawmill	IIw	133	45	80	4.0	4.6	6.9	8.3
977------------ Richwood	I	146	45	80	6.1	4.6	6.9	8.3
981------------ Worthen	I	162	54	97	6.8	6.0	8.0	9.8
981B----------- Worthen	IIe	159	53	95	6.7	5.9	7.9	9.7

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
1485------------ Spillville	Vw	---	---	---	---	3.8	---	3.8
1585------------ Spillville-Coland	Vw	---	---	---	---	3.2	---	3.2
5010**, 5030**. Pits								
5040**. Orthents								
5042**. Udorthents								

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
41, 41B, 41C------- Sparta	3s	Slight	Slight	Severe	Slight	Jack pine-----------	57	Red pine, eastern white pine, jack pine.
						Northern red oak----	47	
						Red pine------------	---	
63B, 63C, 63D------ Chelsea	2s	Slight	Slight	Moderate	Slight	White oak-----------	70	Eastern white pine, red pine, jack pine.
						Red pine------------	72	
						Eastern white pine--	83	
						Jack pine-----------	70	
						Quaking aspen-------	72	
						Northern red oak----	70	
63E---------------- Chelsea	2r	Moderate	Severe	Moderate	Slight	White oak-----------	70	Eastern white pine, red pine, jack pine.
						Red pine------------	72	
						Eastern white pine--	83	
						Jack pine-----------	70	
						Quaking aspen-------	72	
						Northern red oak----	70	
65D2--------------- Lindley	4a	Slight	Slight	Slight	Slight	Blackjack oak-------	50	White oak, green ash, yellow-poplar, black oak.
						Black oak-----------	---	
65E3--------------- Lindley	4r	Moderate	Moderate	Moderate	Slight	Blackjack oak-------	50	White oak, green ash, yellow-poplar, black oak.
						Black oak-----------	---	
109B, 109C--------- Backbone	3a	Slight	Slight	Slight	Slight	Northern red oak----	55	Eastern white pine, red pine, black walnut, sugar maple.
						White oak-----------	55	
110B, 110C--------- Lamont	3a	Slight	Slight	Slight	Slight	Northern red oak----	55	Eastern white pine.
						White oak-----------	55	
129B*:								
Arenzville---------	2a	Slight	Slight	Slight	Slight	Northern red oak----	65	Red pine, eastern white pine, northern red oak, black walnut.
						Bur oak-------------	---	
						Silver maple--------	---	
Chaseburg----------	2a	Slight	Slight	Slight	Slight	Northern red oak----	65	Red pine, eastern white pine, sugar maple, black walnut, northern red oak.
						Sugar maple---------	---	
						American basswood---	---	
158---------------- Dorchester	3a	Slight	Slight	Slight	Slight	White oak-----------	55	Hackberry, green ash, cottonwood.
						Northern red oak----	55	
162B, 162C, 162C2, 162D, 162D2------- Downs	2a	Slight	Slight	Slight	Slight	White oak-----------	65	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak----	65	
163C, 163C2, 163D, 163D2, 163D3------ Fayette	2a	Slight	Slight	Slight	Slight	White oak-----------	65	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak----	65	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
163E, 163E2, 163E3, 163F, 163F2, 163F3, 163G------- Fayette	2r	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, black walnut, sugar maple.
171B, 171C2-------- Bassett	3a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, black walnut, sugar maple.
183C--------------- Dubuque	2a	Slight	Slight	Slight	Slight	Northern red oak---- White oak-----------	65 65	Eastern white pine, red pine, black walnut.
183E--------------- Dubuque	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- White oak-----------	65 65	Eastern white pine, red pine, black walnut.
205B, 207B, 207C--- Whalan	2a	Slight	Slight	Slight	Slight	Eastern white pine-- Northern red oak---- White oak----------- Black walnut--------	58 60 60 55	Northern red oak, white oak, silver maple, eastern white pine.
215C--------------- Goss	3f	Slight	Slight	Slight	Slight	White oak----------- Shortleaf pine------ Post oak------------ Blackjack oak------- Black oak-----------	60 --- --- --- ---	Sweetgum, yellow-poplar, green ash.
221---------------- Palms	3w	Slight	Severe	Severe	Severe	Red maple----------- Silver maple-------- White ash----------- Quaking aspen------- Northern white-cedar Tamarack------------ Black ash-----------	55 --- --- --- --- --- ---	
241B*:								
Burkhardt----------	3a	Slight	Slight	Slight	Slight	Northern pin oak---- Black oak----------- Jack pine-----------	52 --- ---	Eastern white pine, red pine, jack pine, Norway spruce.
Saude.								
285B--------------- Burkhardt	3a	Slight	Slight	Slight	Slight	Northern pin oak---- Black oak----------- Jack pine-----------	52 --- ---	Eastern white pine, red pine, jack pine.
302B--------------- Coggon	2a	Slight	Slight	Slight	Slight	Northern red oak---- White oak-----------	65 65	Eastern white pine, red pine, Norway spruce, black walnut, sugar maple.
353B--------------- Tell	2a	Slight	Slight	Slight	Slight	Northern red oak---- Sugar maple--------- White oak-----------	65 --- ---	Red pine, eastern white pine.
407B--------------- Schley	3w	Slight	Moderate	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, sugar maple.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
412C--------------- Sogn	4d	Slight	Slight	Severe	Severe	White oak----------- Northern red oak----	45 ---	
468B, 468C--------- Olin Variant	3a	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- Shagbark hickory----	60 55 ---	Northern red oak, white oak, eastern white pine, red pine.
471---------------- Oran	3a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, black walnut, sugar maple.
478G*:								
Nordness-----------	4r	Severe	Severe	Severe	Severe	Northern red oak---- White oak-----------	45 45	
Rock outcrop.								
488C2, 488D2------- Newvienna	2a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, black walnut, sugar maple.
499B, 499D--------- Nordness	4d	Slight	Slight	Severe	Severe	Northern red oak---- White oak-----------	45 45	
499F--------------- Nordness	4r	Moderate	Moderate	Severe	Severe	Northern red oak---- White oak-----------	45 45	
663D2-------------- Seaton	2a	Slight	Slight	Slight	Slight	Northern red oak---- Sugar maple--------- American basswood---	70 --- ---	Black walnut, red pine, northern white-cedar.
663E2, 663F3------- Seaton	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- Sugar maple--------- American basswood---	70 --- ---	Black walnut, red pine, northern white-cedar.
725---------------- Hayfield	2a	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- Eastern white pine--	63 63 58	Northern red oak, white oak, silver maple, eastern white pine, black walnut, red pine, white ash.
763E2, 763F2------- Exette	1r	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak---- Black walnut-------- Green ash----------- Sugar maple--------- American basswood--- Black cherry--------	80 80 --- --- --- --- ---	Eastern white pine, red pine, white oak, northern red oak, green ash, black walnut.
771B, 771C--------- Waubeek	2a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, black walnut, sugar maple.
776, 776C---------- Lilah	3s	Slight	Slight	Severe	Slight	Northern red oak----	55	Eastern white pine, white oak.
777---------------- Wapsie	3a	Slight	Slight	Slight	Slight	Northern red oak---- White oak-----------	55 55	Eastern white pine, red pine, black walnut, sugar maple.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
781B--------------- Lourdes	3a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, black walnut, sugar maple.
782B--------------- Donnan	3a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, black walnut, silver maple.
793---------------- Bertrand	2a	Slight	Slight	Slight	Slight	Northern red oak---- White ash----------- White oak----------- Bur oak------------- Black walnut--------	70 --- --- --- ---	Red pine, eastern white pine, black walnut.
826---------------- Rowley	4w	Slight	Moderate	Slight	Slight	Silver maple-------- Red maple----------- White ash----------- American elm--------	70 --- --- ---	Silver maple, white ash.
907B--------------- Schley	3w	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Shagbark hickory----	55 55 60	Eastern white pine, red pine, sugar maple.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
11B*: Colo	---	Redosier dogwood, American plum, Tatarian honeysuckle.	White fir, white spruce, hackberry, Amur maple, tall purple willow.	Green ash, golden willow.	Silver maple, eastern cottonwood.
Ely	---	Redosier dogwood, American plum, Tatarian honeysuckle.	White fir, white spruce, hackberry, Amur maple.	Green ash, golden willow.	---
41, 41B, 41C Sparta	Siberian peashrub	Eastern redcedar, lilac, Tatarian honeysuckle.	Austrian pine, jack pine, red pine, honeylocust, green ash, Russian-olive, Siberian elm.	Eastern white pine	---
63B, 63C, 63D, 63E Chelsea	Siberian peashrub, lilac.	Eastern redcedar, Tatarian honeysuckle.	Red pine, jack pine, Austrian pine.	Eastern white pine	---
65D2, 65E3 Lindley	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Northern white-cedar, eastern redcedar, Amur maple, blue spruce, hackberry, Russian-olive.	Green ash, eastern white pine.	---
83B, 83C, 83C2 Kenyon	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Northern white-cedar, hackberry, blue spruce, eastern redcedar, Russian-olive, Amur maple.	Eastern white pine, green ash.	---
84 Clyde	---	Redosier dogwood, American plum, Tatarian honeysuckle.	Hackberry, Amur maple, northern white-cedar, tall purple willow, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
109B, 109C Backbone	Lilac, Tatarian honeysuckle.	Eastern redcedar, Siberian peashrub, silver buffaloberry.	Russian-olive, eastern white pine, Manchurian crabapple, green ash, hackberry.	Honeylocust, Siberian elm.	---
110B, 110C Lamont	Lilac	Eastern redcedar, Tatarian honeysuckle, Russian-olive, Siberian peashrub.	Eastern white pine, Norway spruce, hackberry, Amur maple, red pine, honeylocust, green ash.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
119. Muscatine	---	Tatarian honeysuckle, redosier dogwood, lilac.	Blue spruce, northern white-cedar, white spruce, Amur maple.	Austrian pine, eastern white pine, hackberry, green ash.	Silver maple.
120B, 120C. Tama	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Northern white-cedar, eastern redcedar, Amur maple, blue spruce, hackberry, Russian-olive.	Green ash, eastern white pine.	---
129B*:					
Arenzville	---	Silky dogwood, Amur privet, American cranberrybush, Amur honeysuckle.	Blue spruce, Austrian pine, Washington hawthorn, white fir, northern white-cedar.	Norway spruce	Pin oak, eastern white pine.
Chaseburg	---	Lilac, redosier dogwood, Tatarian honeysuckle.	White spruce, blue spruce, northern white-cedar, Amur maple.	Eastern white pine, Austrian pine, hackberry, green ash.	Silver maple.
133+. Colo	---	Redosier dogwood, American plum, Tatarian honeysuckle.	White fir, white spruce, hackberry, Amur maple, tall purple willow.	Green ash, golden willow.	Silver maple, eastern cottonwood.
151, 152. Marshan	---	Common ninebark, redosier dogwood, silky dogwood, nannyberry viburnum, American cranberrybush, northern white-cedar.	Balsam fir, white spruce.	Green ash, white ash, red maple, silver maple.	---
153. Marshan	---	Black spruce, redosier dogwood.	Tamarack, black ash, tall purple willow.	Golden willow, black willow, white willow.	---
158. Dorchester	---	Northern white-cedar, Siberian peashrub, Tatarian honeysuckle, lilac.	Hackberry, bur oak, eastern redcedar, white spruce.	Golden willow, honeylocust, green ash.	Eastern cottonwood.
159, 159C. Finchford	Siberian peashrub, Tatarian honeysuckle, lilac.	Eastern redcedar	Red pine, jack pine, Austrian pine.	Eastern white pine	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
162B, 162C, 162C2, 162D, 162D2------ Downs	---	Siberian peashrub, gray dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, hackberry, blue spruce, Russian-olive, eastern redcedar, Amur maple.	Eastern white pine, green ash.	---
163C, 163C2, 163D, 163D2, 163D3, 163E, 163E2, 163E3, 163F, 163F2, 163F3, 163G------------- Fayette	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern white-cedar, hackberry, Russian-olive, blue spruce, Amur maple, eastern redcedar.	Eastern white pine, green ash.	---
171B, 171C2------- Bassett	---	Redosier dogwood, gray dogwood, Siberian peashrub, lilac.	Russian-olive, eastern redcedar, northern white-cedar, blue spruce, Amur maple, hackberry.	Green ash, eastern white pine.	---
174B, 174C-------- Bolan	Lilac, Russian-olive, Tatarian honeysuckle, Siberian peashrub.	Eastern redcedar, Manchurian crabapple, hackberry.	Honeylocust, green ash, eastern white pine, bur oak.	---	---
175, 175B, 175C--- Dickinson	Lilac-------------	Eastern redcedar, Russian-olive, Tatarian honeysuckle, Siberian peashrub.	Eastern white pine, green ash, Norway spruce, honeylocust, red pine, Amur maple, hackberry.	---	---
177, 177B--------- Saude	Lilac, Tatarian honeysuckle, Siberian peashrub.	Manchurian crabapple, hackberry, eastern redcedar.	Eastern white pine, bur oak, jack pine, green ash, honeylocust, Russian-olive.	---	---
178, 178B--------- Waukee	Lilac, Tatarian honeysuckle, Siberian peashrub.	Eastern redcedar, Manchurian crabapple, hackberry.	Russian-olive, green ash, bur oak, jack pine, eastern white pine, honeylocust.	---	---
183C, 183E-------- Dubuque	Tatarian honeysuckle, lilac.	Eastern redcedar, Siberian peashrub.	Hackberry, Russian-olive, Manchurian crabapple, jack pine, eastern white pine, green ash.	Siberian elm, honeysuckle.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
198B: Floyd	---	Redosier dogwood, lilac, Tatarian honeysuckle.	Blue spruce, Amur maple, northern white-cedar, white spruce.	Austrian pine, hackberry, green ash, eastern white pine.	Silver maple.
205B, 207B, 207C: Whalan	Tatarian honeysuckle, lilac.	Eastern redcedar, Siberian peashrub.	Eastern white pine, jack pine, green ash, Manchurian crabapple, hackberry, Russian-olive.	Honeylocust, Siberian elm.	---
213B, 214B: Rockton	Tatarian honeysuckle, lilac.	Eastern redcedar, Siberian peashrub.	Eastern white pine, green ash, hackberry, Manchurian crabapple, Russian-olive, jack pine.	Honeylocust, Siberian elm.	---
215C: Goss	Siberian peashrub	American plum, lilac, Amur honeysuckle, autumn-olive, Tatarian honeysuckle, eastern redcedar, Washington hawthorn, radiant crabapple.	Eastern white pine, jack pine, green ash.	---	---
221: Palms	Vanhoutte spirea	Silky dogwood, common ninebark, nannyberry viburnum, American cranberrybush.	Northern white-cedar, Manchurian crabapple, white spruce.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
225, 226: Lawler	---	Tatarian honeysuckle, redosier dogwood, lilac.	Northern white-cedar, white spruce, blue spruce, Amur maple.	Eastern white pine, hackberry, Austrian pine, green ash.	Silver maple.
241B*:					
Burkhardt	Siberian peashrub, lilac, Tatarian honeysuckle.	Hackberry, Manchurian crabapple, eastern redcedar.	Eastern white pine, honeylocust, jack pine, bur oak, Russian-olive, green ash.	---	---
Saude	Lilac, Tatarian honeysuckle, Siberian peashrub.	Manchurian crabapple, hackberry, eastern redcedar.	Eastern white pine, bur oak, jack pine, green ash, honeylocust, Russian-olive.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
284, 284B---------Flagler	Tatarian honeysuckle, Siberian peashrub, lilac.	Manchurian crabapple, hackberry, eastern redcedar.	Honeylocust, eastern white pine, jack pine, green ash, Russian-olive, bur oak.	---	---
285B--------------Burkhardt	Siberian peashrub, lilac, Tatarian honeysuckle.	Hackberry, Manchurian crabapple, eastern redcedar.	Eastern white pine, honeylocust, jack pine, bur oak, Russian-olive, green ash.	---	---
302B--------------Coggon	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern white-cedar, hackberry, blue spruce, Russian-olive, Amur maple, eastern redcedar.	Eastern white pine, green ash.	---
323B--------------Terril	---	Gray dogwood, Siberian peashrub, redosier dogwood, lilac.	Northern white-cedar, hackberry, blue spruce, Russian-olive, eastern redcedar, Amur maple.	Eastern white pine, green ash.	---
353B--------------Tell	Manyflower cotoneaster.	Siberian peashrub, eastern redcedar, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
377B, 377C, 377C2-Dinsdale	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern white-cedar, hackberry, blue spruce, Amur maple, eastern redcedar, Russian-olive.	Eastern white pine, green ash.	---
391B*:					
Clyde------------	---	Redosier dogwood, American plum, Tatarian honeysuckle.	Hackberry, Amur maple, northern white-cedar, tall purple willow, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
Floyd------------	---	Redosier dogwood, lilac, Tatarian honeysuckle.	Blue spruce, Amur maple, northern white-cedar, white spruce.	Austrian pine, hackberry, green ash, eastern white pine.	Silver maple.
399---------------Readlyn	---	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
407B Schley	---	Redosier dogwood, lilac, Tatarian honeysuckle.	Northern white-cedar, blue spruce, white spruce, Amur maple.	Green ash, Austrian pine, eastern white pine, hackberry.	Silver maple.
408B, 408C Olin	Lilac	Russian-olive, eastern redcedar, Tatarian honeysuckle, Siberian peashrub.	Red pine, green ash, Norway spruce, eastern white pine, Amur maple, hackberry, honeylocust.	---	---
412C. Sogn					
426B, 426C Aredale	---	Redosier dogwood, American plum, gray dogwood, Siberian peashrub, lilac.	Eastern redcedar, Russian-olive, blue spruce, Amur maple, hackberry.	Green ash, eastern white pine.	---
428B Ely	---	Amur maple, silky dogwood, lilac.	White fir, blue spruce, eastern redcedar, northern white-cedar.	Hackberry, eastern white pine, green ash.	Eastern cottonwood.
468B, 468C Olin Variant	---	Tatarian honey-suckle, eastern redcedar, Siberian peashrub, Russian-olive.	Green ash, white spruce, eastern white pine, hackberry.	Norway spruce	---
471 Oran	---	Redosier dogwood, lilac, Tatarian honeysuckle.	Northern white-cedar, blue spruce, Amur maple, red pine.	Austrian pine, eastern white pine, green ash, hackberry.	Silver maple.
478G*: Nordness.					
Rock outcrop.					
485 Spillville	---	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
488C2, 488D2 Newvienna	---	Northern white-cedar, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood.	Norway spruce	Red pine, white ash, red maple, white spruce.	Eastern white pine.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
489-----Ossian	---	Tatarian honeysuckle, redosier dogwood, American plum.	Hackberry, white spruce, northern white-cedar, Amur maple, tall purple willow.	Golden willow, green ash.	Eastern cottonwood, silver maple.
499B, 499D, 499F. Nordness					
585*:					
Spillville-----	---	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
Coland-----	---	Redosier dogwood, Tatarian honeysuckle, American plum.	White spruce, hackberry, northern white-cedar, tall purple willow, Amur maple.	Golden willow, green ash.	Eastern cottonwood, silver maple.
663D2, 663E2, 663E3-----Seaton	---	Gray dogwood, redosier dogwood, lilac, Siberian peashrub.	Hackberry, northern white-cedar, Russian-olive, eastern redcedar, Amur maple, blue spruce.	Eastern white pine, green ash.	---
725-----Hayfield	---	Tatarian honeysuckle, lilac, redosier dogwood.	Blue spruce, northern white-cedar, white spruce, Amur maple.	Eastern white pine, Austrian pine, hackberry, green ash.	Silver maple.
763E2, 763F2-----Exette	---	Redosier dogwood, lilac, gray dogwood, Tatarian honeysuckle, Siberian peashrub.	Eastern redcedar, blue spruce, Amur maple, hackberry, Russian-olive.	Green ash, eastern white pine.	---
771B, 771C-----Waubeek	---	Redosier dogwood, lilac, gray dogwood, Siberian peashrub.	Eastern redcedar, northern white-cedar, blue spruce, Amur maple, hackberry, Russian-olive.	Eastern white pine, green ash.	---
776, 776C-----Lilah	Lilac, Siberian peashrub, Tatarian honeysuckle.	Eastern redcedar	Red pine, Austrian pine, jack pine.	Eastern white pine	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
777 Wapsie	Lilac, Tatarian honeysuckle, Siberian peashrub.	Eastern redcedar, Manchurian crabapple, hackberry.	Russian-olive, jack pine, green ash, bur oak, eastern white pine, honeylocust.	---	---
781B Lourdes	---	Redosier dogwood, lilac, gray dogwood, Siberian peashrub.	Eastern redcedar, northern white-cedar, blue spruce, Amur maple, hackberry, Russian-olive.	Green ash, eastern white pine.	---
782B Donnan	---	Redosier dogwood, lilac, Tatarian honeysuckle.	Blue spruce, white spruce, northern white-cedar, Amur maple.	Green ash, Austrian pine, eastern white pine, hackberry.	Silver maple.
793 Bertrand	---	Lilac, northern white-cedar, Amur maple, American cranberrybush, gray dogwood.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, white ash, red maple.	---
798B Protivin	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern cottonwood, silver maple.
809B, 809C Bertram	Lilac, Tatarian honeysuckle.	Eastern redcedar, Siberian peashrub.	Green ash, Russian-olive, hackberry, Manchurian crabapple, eastern white pine.	Honeylocust, Siberian elm.	---
826 Rowley	---	Northern white-cedar, redosier dogwood, American cranberrybush, nannyberry viburnum, lilac, silky dogwood.	White spruce	Eastern white pine, red pine, white ash, silver maple, red maple.	---
883B Cresken	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern white-cedar, hackberry, blue spruce, eastern redcedar, Russian-olive, Amur maple.	Eastern white pine, green ash.	---
907B Schley	---	Redosier dogwood, lilac, Tatarian honeysuckle.	Northern white-cedar, blue spruce, white spruce, Amur maple.	Green ash, Austrian pine, eastern white pine, hackberry.	Silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
933B-------------- Sawmill	---	Tatarian honeysuckle, American plum, redosier dogwood.	Northern white-cedar, white spruce, tall purple willow, hackberry, Amur maple.	Golden willow, green ash.	Eastern cottonwood, silver maple.
977--------------- Richwood	---	Gray dogwood, northern white-cedar, lilac, Amur maple, American cranberrybush.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, white ash, red maple.	---
981, 981B--------- Worthen	---	Siberian peashrub, redosier dogwood, gray dogwood, lilac.	Eastern redcedar, northern white-cedar, Amur maple, blue spruce, hackberry, Russian-olive.	Green ash, eastern white pine.	---
1485-------------- Spillville	---	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
1585*:					
Spillville-------	---	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
Coland-----------	---	Redosier dogwood, Tatarian honeysuckle, American plum.	White spruce, hackberry, northern white-cedar, tall purple willow, Amur maple.	Golden willow, green ash.	Eastern cottonwood, silver maple.
5010*, 5030*. Pits					
5040*. Orthents					
5042*. Udorthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
11B*:					
Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Ely	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
41 Sparta	Slight	Slight	Slight	Slight	Moderate: droughty.
41B Sparta	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
41C Sparta	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
63B Chelsea	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
63C Chelsea	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
63D Chelsea	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, droughty.
63E Chelsea	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
65D2 Lindley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
65E3 Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
83B Kenyon	Slight	Slight	Moderate: slope.	Slight	Slight.
83C, 83C2 Kenyon	Slight	Slight	Severe: slope.	Slight	Slight.
84 Clyde	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
109B Backbone	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, depth to rock.	Slight	Moderate: thin layer.
109C Backbone	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Moderate: thin layer.
110B Lamont	Slight	Slight	Moderate: slope.	Slight	Slight.
110C Lamont	Slight	Slight	Severe: slope.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
119 Muscatine	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
120B Tama	Slight	Slight	Moderate: slope.	Slight	Slight.
120C Tama	Slight	Slight	Severe: slope.	Slight	Slight.
129B*:					
Arenzville	Severe: flooding.	Slight	Moderate: slope, flooding.	Slight	Moderate: flooding.
Chaseburg	Severe: flooding.	Slight	Moderate: slope, flooding.	Slight	Moderate: flooding.
133+ Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
151, 152 Marshan	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
153 Marshan	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
158 Dorchester	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
159 Finchford	Slight	Slight	Slight	Slight	Moderate: droughty.
159C Finchford	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
162B Downs	Slight	Slight	Moderate: slope.	Slight	Slight.
162C, 162C2 Downs	Slight	Slight	Severe: slope.	Slight	Slight.
162D, 162D2 Downs	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
163C, 163C2 Fayette	Slight	Slight	Severe: slope.	Slight	Slight.
163D, 163D2, 163D3 Fayette	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
163E, 163E2, 163E3, 163F, 163F2, 163F3 Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
163G Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
171B----------------- Bassett	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
171C2---------------- Bassett	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
174B----------------- Bolan	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
174C----------------- Bolan	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
175------------------ Dickinson	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
175B----------------- Dickinson	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
175C----------------- Dickinson	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
177------------------ Saude	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
177B----------------- Saude	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
178------------------ Waukee	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
178B----------------- Waukee	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
183C----------------- Dubuque	Slight----------	Slight----------	Severe: slope.	Slight----------	Moderate: thin layer.
183E----------------- Dubuque	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
198B----------------- Floyd	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Slight.
205B, 207B----------- Whalan	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, depth to rock, percs slowly.	Slight----------	Moderate: thin layer.
207C----------------- Whalan	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight----------	Moderate: thin layer.
213B, 214B----------- Rockton	Slight----------	Slight----------	Moderate: slope, depth to rock.	Slight----------	Moderate: thin layer.
215C----------------- Goss	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight----------	Severe: droughty.
221------------------ Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
225, 226------------- Lawler	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
241B*:					
Burkhardt	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Saude	Slight	Slight	Moderate: slope.	Slight	Slight.
284 Flagler	Slight	Slight	Slight	Slight	Slight.
284B Flagler	Slight	Slight	Moderate: slope.	Slight	Slight.
285B Burkhardt	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
302B Coggon	Slight	Slight	Moderate: slope.	Slight	Slight.
323B Terril	Slight	Slight	Moderate: slope.	Slight	Slight.
353B Tell	Slight	Slight	Moderate: slope.	Slight	Slight.
377B Dinsdale	Slight	Slight	Moderate: slope.	Slight	Slight.
377C, 377C2 Dinsdale	Slight	Slight	Severe: slope.	Slight	Slight.
391B*:					
Clyde	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Floyd	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Slight.
399 Readlyn	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
407B Schley	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
408B Olin	Slight	Slight	Moderate: slope.	Slight	Slight.
408C Olin	Slight	Slight	Severe: slope.	Slight	Slight.
412C Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: thin layer.
426B Aredale	Slight	Slight	Moderate: slope.	Slight	Slight.
426C Aredale	Slight	Slight	Severe: slope.	Slight	Slight.
428B Ely	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
468B----------------- Olin Variant	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
468C----------------- Olin Variant	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
471------------------ Oran	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight----------	Slight.
478G*:					
Nordness------------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.	Severe: slope, thin layer.
Rock outcrop.					
485------------------ Spillville	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
488C2---------------- Newvienna	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
488D2---------------- Newvienna	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
489------------------ Ossian	Severe: wetness, flooding.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
499B----------------- Nordness	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Severe: thin layer.
499D----------------- Nordness	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.	Severe: thin layer.
499F----------------- Nordness	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.	Severe: slope, thin layer.
585*:					
Spillville----------	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
Coland--------------	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
663D2---------------- Seaton	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
663E2, 663E3--------- Seaton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
725------------------ Hayfield	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
763E2, 763F2--------- Exette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
771B----------------- Waubeek	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
771C Waubeek	Slight	Slight	Severe: slope.	Slight	Slight.
776 Lilah	Slight	Slight	Moderate: small stones.	Slight	Moderate: droughty.
776C Lilah	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
777 Wapsie	Slight	Slight	Slight	Slight	Slight.
781B Lourdes	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
782B Donnan	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
793 Bertrand	Slight	Slight	Slight	Slight	Slight.
798B Protivin	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Slight.
809B Bertram	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: thin layer.
809C Bertram	Slight	Slight	Severe: slope.	Slight	Moderate: thin layer.
826 Rowley	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
883B Cresken	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
907B Schley	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
933B Sawmill	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
977 Richwood	Slight	Slight	Slight	Slight	Slight.
981 Worthen	Slight	Slight	Slight	Slight	Slight.
981B Worthen	Slight	Slight	Moderate: slope.	Slight	Slight.
1485 Spillville	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1585*:					
Spillville	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Coland	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
5010*, 5030*. Pits					
5040*. Orthents					
5042*. Udorthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
11B*:										
Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
Ely	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
41, 41B Sparta	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
41C Sparta	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
63B, 63C Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
63D, 63E Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
65D2 Lindley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
65E3 Lindley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
83B Kenyon	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
83C, 83C2 Kenyon	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
84 Clyde	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
109B Backbone	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
109C Backbone	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
110B Lamont	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
110C Lamont	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
119 Muscatine	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
120B Tama	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
120C Tama	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
129B*:										
Arenzville	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
129B*: Chaseburg	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
133+ Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
151, 152 Marshan	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
153 Marshan	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
158 Dorchester	Fair	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor	Poor.
159, 159C Finchford	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
162B Downs	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
162C, 162C2, 162D, 162D2 Downs	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
163C, 163C2, 163D, 163D2 Fayette	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
163D3 Fayette	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
163E, 163E2, 163E3, 163F, 163F2, 163F3 Fayette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
163G Fayette	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
171B Bassett	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
171C2 Bassett	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
174B Bolan	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
174C Bolan	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
175, 175B Dickinson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
175C Dickinson	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
177, 177B Saude	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
178, 178B: Waukee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
183C: Dubuque	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
183E: Dubuque	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
198B: Floyd	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
205B, 207B, 207C: Whalan	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
213B, 214B: Rockton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
215C: Goss	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
221: Palms	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
225, 226: Lawler	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
241B*:										
Burkhardt	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Saude	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
284, 284B: Flagler	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
285B: Burkhardt	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
302B: Coggon	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
323B: Terril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
353B: Tell	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
377B: Dinsdale	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
377C, 377C2: Dinsdale	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
391B*:										
Clyde	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
Floyd	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
399 Readlyn	Good	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
407B Schley	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
408B Olin	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
408C Olin	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
412C Sogn	Very poor.	Very poor.	Poor	---	---	Very poor.	Very poor.	Very poor.	---	Very poor.
426B Aredale	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
426C Aredale	Fair	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Poor.
428B Ely	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
468B Olin Variant	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
468C Olin Variant	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
471 Oran	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
478G*:										
Nordness	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
485 Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
488C2, 488D2 Newvienna	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
489 Ossian	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
499B, 499D Nordness	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
499F Nordness	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
585*:										
Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Coland	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
663D2 Seaton	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
663E2, 663E3 Seaton	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
725 Hayfield	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
763E2, 763F2 Exette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
771B Waubeek	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
771C Waubeek	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
776 Lilah	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
776C Lilah	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
777 Wapsie	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
781B Lourdes	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
782B Donnan	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
793 Bertrand	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
798B Protivin	Good	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
809B Bertram	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
809C Bertram	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
826 Rowley	Good	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
883B Cresken	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
907B Schley	Good	Good	Good	Fair	Fair	Fair	Fair	Good	Good	Fair.
933B Sawmill	Good	Good	Good	Fair	Fair	Good	Fair	Good	Fair	Fair.
977 Richwood	Good	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
981, 981B Worthen	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
1485 Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1585*:										
Spillville---------	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Coland------------	Poor	Fair	Fair	Poor	Poor	Good	Good	Poor	Poor	Good.
5010*, 5030*. Pits										
5040*. Orthents										
5042*. Udorthents										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
11B*:						
Colo	Severe: wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, low strength, frost action.	Moderate: wetness, flooding.
Ely	Severe: wetness.	Severe: low strength.	Severe: low strength, wetness.	Severe: low strength.	Severe: frost action, low strength.	Slight.
41, 41B Sparta	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
41C Sparta	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
63B Chelsea	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
63C Chelsea	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
63D Chelsea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, droughty.
63E Chelsea	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
65D2 Lindley	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
65E3 Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
83B Kenyon	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.	Slight.
83C, 83C2 Kenyon	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.	Slight.
84 Clyde	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
109B Backbone	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, frost action.	Moderate: thin layer.
109C Backbone	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, frost action.	Moderate: thin layer.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
110B Lamont	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
110C Lamont	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
119 Muscatine	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
120B Tama	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
120C Tama	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
129B*:						
Arenzville	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
Chaseburg	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
133+ Colo	Severe: wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, low strength, frost action.	Moderate: wetness, flooding.
151, 152 Marshan	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
153 Marshan	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, frost action.	Severe: ponding.
158 Dorchester	Severe: excess humus.	Severe: flooding.	Severe: flooding, low strength.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
159 Finchford	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
159C Finchford	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
162B Downs	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
162C, 162C2 Downs	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
162D, 162D2 Downs	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
163C, 163C2------- Fayette	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
163D, 163D2------- Fayette	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
163D3------------- Fayette	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
163E, 163E2, 163E3, 163F, 163F2, 163F3, 163G------------- Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
171B-------------- Bassett	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
171C2------------- Bassett	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength, frost action.	Slight.
174B-------------- Bolan	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
174C-------------- Bolan	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
175, 175B--------- Dickinson	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
175C-------------- Dickinson	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
177, 177B--------- Saude	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
178, 178B--------- Waukee	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
183C-------------- Dubuque	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength, frost action.	Moderate: thin layer.
183E-------------- Dubuque	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
198B-------------- Floyd	Severe: cutbanks cave, excess humus, wetness.	Severe: low strength.	Severe: wetness.	Severe: low strength.	Severe: low strength, frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
205B, 207B-------- Whalan	Moderate: depth to rock, too clayey.	Slight---------	Moderate: depth to rock.	Slight---------	Severe: low strength.	Moderate: thin layer.
207C-------------- Whalan	Moderate: depth to rock, too clayey.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Severe: low strength.	Moderate: thin layer.
213B, 214B-------- Rockton	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Moderate: thin layer.
215C-------------- Goss	Moderate: too clayey, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, slope, large stones.	Moderate: low strength, frost action.	Severe: droughty.
221--------------- Palms	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
225, 226---------- Lawler	Severe: wetness, cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
241B*:						
Burkhardt--------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
Saude------------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
284, 284B--------- Flagler	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
285B-------------- Burkhardt	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
302B-------------- Coggon	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
323B-------------- Terril	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
353B-------------- Tell	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
377B-------------- Dinsdale	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
377C, 377C2------- Dinsdale	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
391B*:						
Clyde	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Floyd	Severe: cutbanks cave, excess humus, wetness.	Severe: low strength.	Severe: wetness.	Severe: low strength.	Severe: low strength, frost action.	Slight.
399 Readlyn	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
407B Schley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe:	Moderate:
408B Olin	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
408C Olin	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
412C Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
426B Aredale	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.	Slight.
426C Aredale	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.	Slight.
428B Ely	Severe: wetness.	Severe: low strength.	Severe: low strength, wetness.	Severe: low strength.	Severe: frost action, low strength.	Slight.
468B Olin Variant	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
468C Olin Variant	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
471 Oran	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
478G*:						
Nordness	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, thin layer.
Rock outcrop.						
485 Spillville	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
488C2 Newvienna	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
488D2 Newvienna	Moderate: wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
489 Ossian	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
499B Nordness	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
499D Nordness	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: thin layer.
499F Nordness	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, thin layer.
585*:						
Spillville	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Coland	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
663D2 Seaton	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
663E2, 663E3 Seaton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
725 Hayfield	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Severe: frost action.	Slight.
763E2, 763F2 Exette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
771B Waubeek	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
771C Waubeek	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
776 Lilah	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
776C Lilah	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
777 Wapsie	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
781B-------------- Lourdes	Moderate: dense layer, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
782B-------------- Donnan	Moderate: wetness, too clayey.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell, frost action.	Slight.
793--------------- Bertrand	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
798B-------------- Protivin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
809B-------------- Bertram	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, frost action.	Moderate: thin layer.
809C-------------- Bertram	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, frost action.	Moderate: thin layer.
826--------------- Rowley	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
883B-------------- Cresken	Moderate: dense layer, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
907B-------------- Schley	Severe: cutbanks cave, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.	Slight.
933B-------------- Sawmill	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
977--------------- Richwood	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action.	Slight.
981, 981B--------- Worthen	Slight---------	Slight---------	Slight---------	Slight---------	Severe: low strength, frost action.	Slight.
1485-------------- Spillville	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
1585*:						
Spillville-------	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
Coland-----------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, frost action.	Severe: flooding.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
5010*, 5030*. Pits						
5040*. Orthents						
5042*. Udorthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
11B*:					
Colo	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Poor: wetness, hard to pack.
Ely	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
41, 41B Sparta	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
41C Sparta	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
63B Chelsea	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
63C, 63D Chelsea	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
63E Chelsea	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
65D2 Lindley	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
65E3 Lindley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
83B Kenyon	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
83C, 83C2 Kenyon	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
84 Clyde	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
109B Backbone	Severe: depth to rock, percs slowly.	Severe: seepage, depth to rock.	Severe: depth to rock.	Severe: depth to rock, seepage.	Poor: area reclaim.
109C Backbone	Severe: depth to rock, percs slowly.	Severe: seepage, depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock, seepage.	Poor: area reclaim.
110B Lamont	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
110C--- Lamont	Slight---	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
119--- Muscatine	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
120B--- Tama	Slight---	Moderate: slope, seepage.	Moderate: too clayey.	Slight---	Fair: too clayey.
120C--- Tama	Slight---	Severe: slope.	Moderate: too clayey.	Slight---	Fair: too clayey.
129B*:					
Arenzville---	Severe: flooding.	Severe: flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: too sandy.
Chaseburg---	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
133+--- Colo	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Poor: wetness, hard to pack.
151, 152--- Marshan	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
153--- Marshan	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
158--- Dorchester	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: thin layer.
159, 159C--- Finchford	Severe: poor filter.	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
162B--- Downs	Slight---	Moderate: slope, seepage.	Moderate: too clayey.	Slight---	Fair: too clayey.
162C, 162C2--- Downs	Slight---	Severe: slope.	Moderate: too clayey.	Slight---	Fair: too clayey.
162D, 162D2--- Downs	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
163C, 163C2--- Fayette	Slight---	Severe: slope.	Moderate: too clayey.	Slight---	Fair: too clayey.
163D, 163D2, 163D3-- Fayette	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
163E, 163E2, 163E3, 163F, 163F2, 163F3, 163G----------------- Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
171B----------------- Bassett	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
171C2---------------- Bassett	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
174B----------------- Bolan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
174C----------------- Bolan	Severe: poor filter.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
175, 175B------------ Dickinson	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
175C----------------- Dickinson	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
177, 177B------------ Saude	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage, small stones.
178, 178B------------ Waukee	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
183C----------------- Dubuque	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
183E----------------- Dubuque	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
198B----------------- Floyd	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.
205B, 207B----------- Whalan	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
207C----------------- Whalan	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
213B, 214B----------- Rockton	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
215C----------------- Goss	Moderate: percs slowly, large stones.	Severe: seepage.	Severe: too clayey, large stones.	Severe: seepage.	Poor: too clayey, small stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
221----------------- Palms	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
225, 226------------ Lawler	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
241B*:					
Burkhardt----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones.
Saude--------------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage, small stones.
284, 284B----------- Flagler	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
285B---------------- Burkhardt	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones.
302B---------------- Coggon	Moderate: percs slowly.	Moderate: slope, seepage.	Slight-----------	Slight-----------	Good.
323B---------------- Terril	Slight-----------	Severe: seepage.	Severe: seepage.	Slight-----------	Good.
353B---------------- Tell	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
377B---------------- Dinsdale	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
377C, 377C2--------- Dinsdale	Moderate: percs slowly.	Severe: slope.	Slight-----------	Slight-----------	Good.
391B*:					
Clyde--------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Floyd--------------	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.
399----------------- Readlyn	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
407B---------------- Schley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
408B---------------- Olin	Slight-----------	Moderate: slope, seepage.	Slight-----------	Slight-----------	Good.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
408C Olin	Slight	Severe: slope.	Slight	Slight	Good.
412C Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
426B Aredale	Slight	Severe: seepage.	Slight	Severe: seepage.	Good.
426C Aredale	Slight	Severe: slope, seepage.	Slight	Severe: seepage.	Good.
428B Ely	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
468B Olin Variant	Moderate: percs slowly.	Severe: seepage.	Moderate: too clayey.	Severe: seepage.	Fair: too clayey.
468C Olin Variant	Moderate: percs slowly.	Severe: seepage, slope.	Moderate: too clayey.	Severe: seepage.	Fair: too clayey.
471 Oran	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
478G*:					
Nordness	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: area reclaim, slope.
Rock outcrop.					
485 Spillville	Severe: wetness, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, flooding.	Fair: wetness.
488C2 Newvienna	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
488D2 Newvienna	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, slope, wetness.
489 Ossian	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
499B Nordness	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
499D Nordness	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
499F Nordness	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: area reclaim, slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
585*:					
Spillville	Severe: wetness, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, flooding.	Fair: wetness.
Coland	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
663D2 Seaton	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
663E2, 663E3 Seaton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
725 Hayfield	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
763E2, 763F2 Exette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
771B Waubeek	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
771C Waubeek	Slight	Severe: slope.	Slight	Slight	Good.
776, 776C Lilah	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
777 Wapsie	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
781B Lourdes	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
782B Donnan	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
793 Bertrand	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Fair: too clayey, thin layer.
798B Protivin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
809B Bertram	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock.	Severe: seepage, depth to rock.	Poor: area reclaim.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
809C Bertram	Severe: depth to rock.	Severe: depth to rock, slope, seepage.	Severe: depth to rock.	Severe: seepage, depth to rock.	Poor: area reclaim.
826 Rowley	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
883B Cresken	Severe: percs slowly.	Moderate: seepage, slope, wetness.	Moderate: too clayey.	Slight	Fair: too clayey.
907B Schley	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: wetness, thin layer.
933B Sawmill	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
977 Richwood	Slight	Severe: seepage.	Severe: seepage.	Slight	Fair: too clayey, thin layer.
981 Worthen	Slight	Moderate: seepage.	Slight	Slight	Good.
981B Worthen	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
1485 Spillville	Severe: wetness, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, flooding.	Fair: wetness.
1585*:					
Spillville	Severe: wetness, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, flooding.	Fair: wetness.
Coland	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
5010*, 5030*. Pits					
5040*. Orthents					
5042*. Udorthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
11B*:				
Colo	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ely	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
41, 41B, 41C Sparta	Good	Probable	Improbable: too sandy.	Poor: thin layer.
63B, 63C Chelsea	Good	Probable	Improbable: too sandy.	Fair: too sandy.
63D Chelsea	Good	Probable	Improbable: too sandy.	Fair: too sandy, slope.
63E Chelsea	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
65D2 Lindley	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
65E3 Lindley	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
83B, 83C, 83C2 Kenyon	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
84 Clyde	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
109B, 109C Backbone	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
110B, 110C Lamont	Good	Probable	Improbable: too sandy.	Good.
119 Muscatine	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
120B, 120C Tama	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
129B*:				
Arenzville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
Chaseburg	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
133+ Colo	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
151, 152 Marshan	Fair: wetness.	Probable	Probable	Fair: area reclaim, thin layer.
153 Marshan	Poor: wetness.	Probable	Probable	Poor: wetness.
158 Dorchester	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
159, 159C Finchford	Good	Probable	Improbable: too sandy.	Fair: too sandy.
162B, 162C, 162C2 Downs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
162D, 162D2 Downs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
163C, 163C2 Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
163D, 163D2 Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
163D3 Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
163E, 163E2, 163E3, 163F, 163F2, 163F3 Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
163G Fayette	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
171B, 171C2 Bassett	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
174B, 174C Bolan	Good	Probable	Improbable: too sandy.	Good.
175, 175B, 175C Dickinson	Good	Probable	Improbable: too sandy.	Good.
177, 177B Saude	Good	Probable	Probable	Good.
178, 178B Waukee	Good	Probable	Probable	Good.
183C Dubuque	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
183E Dubuque	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
198B Floyd	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
205B, 207B, 207C: Whalan	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
213B, 214B: Rockton	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
215C: Goss	Fair: low strength, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
221: Palms	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
225, 226: Lawler	Fair: wetness.	Probable	Probable	Poor: area reclaim.
241B*:				
Burkhardt	Good	Probable	Probable	Poor: small stones, area reclaim.
Saude	Good	Probable	Probable	Good.
284, 284B: Flagler	Good	Probable	Probable	Fair: small stones, area reclaim, thin layer.
285B: Burkhardt	Good	Probable	Probable	Poor: small stones, area reclaim.
302B: Coggon	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
323B: Terril	Good	Probable	Improbable: too sandy.	Good.
353B: Tell	Good	Probable	Improbable: too sandy.	Fair: thin layer.
377B, 377C, 377C2: Dinsdale	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
391B*:				
Clyde	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Floyd	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
399: Readlyn	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
407B: Schley	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
408B, 408C Olin	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
412C Sogn	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
426B, 426C Aredale	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
428B Ely	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
468B, 468C Olin Variant	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
471 Oran	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
478G*:				
Nordness	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Rock outcrop.				
485 Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
488C2 Newvienna	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
488D2 Newvienna	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
489 Ossian	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
499B, 499D Nordness	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
499F Nordness	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
585*:				
Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
663D2 Seaton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
663E2, 663E3 Seaton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
725 Hayfield	Fair: wetness.	Probable	Improbable: too sandy.	Poor: area reclaim.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
763E2, 763F2 Exette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
771B, 771C Waubeek	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
776, 776C Lilah	Good	Probable	Probable	Poor: small stones, area reclaim.
777 Wapsie	Good	Probable	Probable	Fair: small stones, area reclaim, thin layer.
781B Lourdes	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
782B Donnan	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
793 Bertrand	Good	Probable	Improbable: too sandy.	Good.
798B Protivin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
809B, 809C Bertram	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
826 Rowley	Fair: wetness.	Probable	Improbable: too sandy.	Good.
883B Cresken	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
907B Schley	Fair: wetness.	Probable	Improbable: too sandy.	Fair: small stones.
933B Sawmill	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
977 Richwood	Good	Probable	Improbable: too sandy.	Good.
981, 981B Worthen	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
1485 Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
1585*:				
Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
5010*, 5030*. Pits				
5040*. Orthents				
5042*. Udorthents				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
11B*:						
Colo	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness	Wetness.
Ely	Moderate: slope, seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Slope, frost action.	Erodes easily, wetness.	Erodes easily.
41, 41B, 41C Sparta	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
63B, 63C Chelsea	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
63D, 63E Chelsea	Severe: slope, seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty.
65D2, 65E3 Lindley	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope	Slope.
83B, 83C, 83C2 Kenyon	Moderate: slope, seepage.	Moderate: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
84 Clyde	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness, erodes easily.
109B, 109C Backbone	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, soil blowing.	Depth to rock, rooting depth.
110B, 110C Lamont	Severe: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Soil blowing	Favorable.
119 Muscatine	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action	Wetness, erodes easily.	Erodes easily.
120B, 120C Tama	Moderate: slope, seepage.	Slight	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
129B*:						
Arenzville	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily, too sandy.	Erodes easily.
Chaseburg	Moderate: seepage, slope.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
133+ Colo	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness	Wetness.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
151, 152 Marshan	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, too sandy.	Wetness.
153 Marshan	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, too sandy.	Wetness.
158 Dorchester	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
159, 159C Finchford	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
162B, 162C, 162C2 Downs	Moderate: slope, seepage.	Slight	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
162D, 162D2 Downs	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
163C, 163C2 Fayette	Moderate: slope, seepage.	Slight	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
163D, 163D2, 163D3, 163E, 163E2, 163E3, 163F, 163F2, 163F3, 163G Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
171B, 171C2 Bassett	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
174B, 174C Bolan	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy	Favorable.
175, 175B, 175C Dickinson	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Soil blowing, too sandy.	Favorable.
177, 177B Saude	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy	Favorable.
178, 178B Waukee	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy	Favorable.
183C Dubuque	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, erodes easily.	Erodes easily, depth to rock.
183E Dubuque	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
198B Floyd	Severe: seepage.	Moderate: piping, wetness.	Severe: cutbanks cave.	Frost action	Wetness	Favorable.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
205B, 207B, 207C-- Whalan	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock, percs slowly.
213B, 214B-------- Rockton	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock.
215C-------------- Goss	Moderate: seepage, slope.	Severe: large stones.	Severe: no water.	Deep to water	Large stones---	Large stones, droughty.
221--------------- Palms	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
225, 226---------- Lawler	Severe: seepage.	Severe: seepage.	Moderate: cutbanks cave, deep to water, slow refill.	Frost action, cutbanks cave.	Wetness, too sandy.	Favorable.
241B*:						
Burkhardt--------	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Soil blowing, too sandy.	Droughty.
Saude------------	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy------	Favorable.
284, 284B--------- Flagler	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Favorable.
285B-------------- Burkhardt	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Soil blowing, too sandy.	Droughty.
302B-------------- Coggon	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
323B-------------- Terril	Moderate: seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
353B-------------- Tell	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Erodes easily, too sandy.	Erodes easily.
377B, 377C, 377C2- Dinsdale	Moderate: slope, seepage.	Slight---------	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
391B*:						
Clyde------------	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness--------	Wetness, erodes easily.
Floyd------------	Severe: seepage.	Moderate: piping, wetness.	Severe: cutbanks cave.	Frost action---	Wetness--------	Favorable.
399--------------- Readlyn	Moderate: seepage.	Moderate: wetness, piping.	Moderate: deep to water, slow refill.	Frost action---	Wetness--------	Favorable.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
407B-------------- Schley	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness--------	Wetness, rooting depth.
408B, 408C-------- Olin	Moderate: slope, seepage.	Slight---------	Severe: no water.	Deep to water	Soil blowing---	Favorable.
412C-------------- Sogn	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock.
408B, 408C-------- Olin	Moderate: slope, seepage.	Slight---------	Severe: no water.	Deep to water	Soil blowing---	Favorable.
412C-------------- Sogn	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock.
426B, 426C-------- Aredale	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
428B-------------- Ely	Moderate: slope, seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Slope, frost action.	Erodes easily, wetness.	Erodes easily.
468B, 468C-------- Olin Variant	Severe: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Soil blowing---	Favorable.
471--------------- Oran	Moderate: seepage.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Frost action---	Wetness--------	Favorable.
478G*:						
Nordness---------	Severe: slope, depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Rock outcrop.						
485--------------- Spillville	Moderate: seepage.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Favorable------	Favorable.
488C2------------- Newvienna	Moderate: seepage, slope.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action, slope.	Erodes easily, wetness.	Erodes easily.
488D2------------- Newvienna	Severe: slope.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily.
489--------------- Ossian	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness--------	Wetness.
499B-------------- Nordness	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, erodes easily.	Droughty, erodes easily.
499D, 499F-------- Nordness	Severe: slope, depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
585*:						
Spillville	Moderate: seepage.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Favorable	Favorable.
Coland	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness	Wetness.
663D2, 663E2, 663E3 Seaton	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
725 Hayfield	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, too sandy.	Favorable.
763E2, 763F2 Exette	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
771B, 771C Waubeek	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
776, 776C Lilah	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
777 Wapsie	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy	Favorable.
781B Lourdes	Moderate: slope.	Slight	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
782B Donnan	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, percs slowly.	Percs slowly.
793 Bertrand	Moderate: seepage.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
798B Protivin	Moderate: slope.	Moderate: wetness.	Severe: slow refill.	Frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
809B, 809C Bertram	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, soil blowing.	Depth to rock.
826 Rowley	Moderate: seepage.	Severe: wetness.	Severe: cutbanks cave.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
883B Cresken	Moderate: slope.	Moderate: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
907B Schley	Severe: seepage.	Severe: seepage.	Severe: cutbanks cave.	Frost action	Wetness	Favorable.
933B Sawmill	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness	Wetness.
977 Richwood	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
981 Worthen	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
981B-------------- Worthen	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
1485-------------- Spillville	Moderate: seepage.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Favorable------	Favorable.
1585*:						
Spillville--------	Moderate: seepage.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Favorable------	Favorable.
Coland------------	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness--------	Wetness.
5010*, 5030*. Pits						
5040*. Orthents						
5042*. Udorthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
11B*:											
Colo	0-18	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	18-47	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	47-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
Ely	0-26	Silty clay loam	CL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	26-49	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
	49-60	Silt loam, silty clay loam, loam.	CL	A-6	0	100	100	90-100	85-100	25-40	10-20
41, 41B, 41C Sparta	0-17	Loamy fine sand	SM	A-2, A-4	0	85-100	85-100	50-95	15-50	---	NP
	17-44	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	85-100	85-100	50-95	5-50	---	NP
	44-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	85-100	85-100	50-95	2-30	---	NP
63B, 63C, 63D, 63E Chelsea	0-37	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	37-60	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
65D2 Lindley	0-7	Loam	CL	A-6	0	95-100	90-100	85-95	50-65	25-35	10-15
	7-43	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	12-20
	43-60	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	25-35	10-15
65E3 Lindley	0-7	Clay loam	CL	A-6	0	95-100	90-100	85-95	55-75	30-40	15-20
	7-43	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	12-20
	43-60	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	25-35	10-15
83B, 83C, 83C2 Kenyon	0-17	Loam	CL	A-6	0	100	95-100	85-95	65-75	30-40	10-20
	17-54	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-95	80-90	50-65	30-40	10-20
	54-60	Loam	CL	A-6	0-5	90-95	85-95	80-90	50-65	25-35	10-20
84 Clyde	0-23	Clay loam	OL, MH, ML, OH	A-7	0-5	95-100	95-100	80-90	55-75	45-60	15-25
	23-34	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	90-95	75-90	50-75	30-50	10-20
	34-41	Sandy loam, loam, sandy clay loam.	SM, SM-SC	A-2	2-5	80-95	75-90	50-80	15-35	15-20	NP-5
	41-60	Loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-90	45-65	25-35	10-20
109B, 109C Backbone	0-12	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	75-85	15-40	15-25	5-10
	12-29	Sandy loam	SC, SM-SC	A-2, A-4	0-2	90-95	90-95	65-80	20-40	15-25	5-10
	29-32	Clay loam, clay, sandy clay loam.	CL, CH	A-6, A-7	2-5	90-95	90-95	70-80	50-75	35-55	20-30
	32-36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
110B, 110C Lamont	0-5	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	5-11	Fine sandy loam, loamy fine sand.	SM, SM-SC	A-2, A-4	0	100	100	80-95	15-50	<25	NP-5
	11-31	Fine sandy loam, loam, sandy clay loam.	SM-SC, SC	A-2, A-4	0	100	100	85-95	30-50	20-30	5-10
	31-60	Loamy fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	70-90	5-25	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
119-------------- Muscatine	0-22	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	22-43	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	43-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
120B, 120C------- Tama	0-20	Silt loam--------	ML	A-6, A-7	0	100	100	100	95-100	35-50	10-20
	20-40	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	40-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
129B*:											
Arenzville------	0-25	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	95-100	80-90	25-35	5-10
	25-35	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	85-95	20-45	5-20
	35-60	Stratified silt loam to sand.	CL, CL-ML	A-4	0	75-100	70-95	65-95	60-85	20-30	5-10
Chaseburg-------	0-8	Silt loam--------	ML, CL-ML	A-4	0	100	100	90-100	85-100	<26	3-7
	8-60	Silt loam--------	ML, CL-ML, CL	A-4	0	85-100	85-100	80-100	75-100	<28	3-9
133+------------- Colo	0-18	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	18-47	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	47-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
151-------------- Marshan	0-22	Clay loam--------	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	35-50	15-25
	22-30	Silty clay loam, clay loam, silt loam.	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	30-50	15-30
	30-35	Loam, sandy loam	CL, CL-ML, SC, SM-SC	A-6, A-4	0	95-100	75-100	70-90	45-75	25-40	5-15
	35-60	Coarse sand, gravelly coarse sand, sand.	SP, SW	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
152-------------- Marshan	0-22	Clay loam--------	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	35-50	15-25
	22-34	Silty clay loam, clay loam, silt loam.	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	30-50	15-30
	34-38	Loam, sandy loam	CL, CL-ML, SC, SM-SC	A-6, A-4	0	95-100	75-100	70-90	45-75	25-40	5-15
	38-60	Coarse sand, gravelly sand, sand.	SP, SW	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
153-------------- Marshan	0-15	Silty clay loam	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	35-50	15-25
	15-19	Silty clay loam, clay loam, silt loam.	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	30-50	15-30
	19-29	Loam, sandy loam	CL, CL-ML, SM-SC, SC	A-6, A-4	0	95-100	75-100	70-90	40-75	25-40	5-15
	29-60	Coarse sand, gravelly sand, sand.	SP, SW	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
158-------------- Dorchester	0-5	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	95-100	90-95	25-35	5-10
	5-60	Silt loam, silty clay loam, clay loam.	OL, ML, CL	A-6, A-7	0	100	100	95-100	90-95	35-45	10-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
159, 159C--------- Finchford	0-14	Loamy sand-------	SP-SM, SM	A-2, A-3	0	85-95	70-90	50-60	5-15	---	NP
	14-29	Sand, loamy sand	SW-SM, SP-SM	A-1	0	80-90	60-75	25-40	5-10	---	NP
	29-60	Gravelly loamy sand.	SW, SP	A-1	0	75-95	55-95	20-35	3-5	---	NP
162B, 162C, 162C2, 162D, 162D2----------- Downs	0-18	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	18-44	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	44-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163C, 163C2, 163D, 163D2----- Fayette	0-12	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	12-46	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	46-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163D3------------ Fayette	0-12	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	12-46	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	46-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163E, 163E2------ Fayette	0-12	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	12-46	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	46-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163E3------------ Fayette	0-12	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	12-46	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	46-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163F, 163F2------ Fayette	0-12	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	12-46	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	46-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163F3------------ Fayette	0-12	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	12-46	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	46-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163G------------- Fayette	0-12	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	12-46	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	46-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
171B, 171C2------ Bassett	0-20	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	65-85	20-30	5-15
	20-42	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	11-20
	42-60	Loam-------------	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	11-20
174B, 174C------- Bolan	0-20	Loam-------------	CL, ML	A-4, A-6	0	100	100	85-95	50-70	30-40	5-15
	20-28	Loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	100	80-90	40-55	25-35	5-15
	28-41	Fine sandy loam	SM, SM-SC, SC	A-4	0	100	100	80-90	35-50	15-25	2-8
	41-60	Loamy fine sand, fine sand.	SM, SP-SM	A-2	0	100	100	70-85	10-30	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
175, 175B, 175C-- Dickinson	0-7	Fine sandy loam	SM, SC, SM-SC	A-4, A-2	0	100	100	85-95	30-50	15-30	NP-10
	7-28	Fine sandy loam, sandy loam.	SM, SC, SM-SC	A-4	0	100	100	85-95	35-50	15-30	NP-10
	28-40	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	80-95	5-20	10-20	NP-5
	40-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	100	100	70-90	5-20	---	NP
177, 177B-------- Saude	0-13	Loam-------------	CL	A-6	0	100	90-100	70-90	50-75	25-35	10-15
	13-29	Loam, sandy loam	CL, SC, CL-ML, SM-SC	A-4, A-6	0-5	85-95	80-95	70-85	45-60	20-30	5-15
	29-60	Loamy sand, gravelly coarse sand, sand.	SW, SM, GP, GM	A-1	2-10	50-90	50-85	20-40	3-25	---	NP
178, 178B-------- Waukee	0-21	Loam-------------	CL	A-6	0	100	90-100	70-90	50-75	30-40	10-20
	21-35	Loam, sandy clay loam.	CL, SM-SC, SC, CL-ML	A-6, A-4	0-5	85-95	80-95	65-85	40-60	20-35	5-15
	35-60	Gravelly loamy sand, loamy coarse sand, sand.	SW, SM, SP-SM, SP	A-1	2-10	60-90	60-85	20-40	3-25	---	NP
183C, 183E------- Dubuque	0-12	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	12-23	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	23-28	Clay, silty clay	CH	A-7	2-10	85-95	80-90	70-85	65-85	50-70	30-45
	28-32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
198B------------- Floyd	0-22	Loam-------------	OL, ML, CL	A-4, A-6	0	100	100	80-90	55-75	30-40	5-15
	22-30	Sandy clay loam, loam.	CL	A-6	2-8	90-95	70-80	50-70	50-65	25-35	11-20
	30-36	Sandy loam, loamy sand.	SM, SM-SC	A-2	2-5	90-95	70-80	50-70	15-35	10-20	NP-5
	36-60	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-35	11-20
205B------------- Whalan	0-11	Loam-------------	ML	A-4	0	100	95-100	85-95	60-90	30-40	5-10
	11-30	Clay loam, loam	CL	A-6	0	95-100	95-100	80-95	70-90	30-40	10-15
	30-34	Clay loam, clay, silty clay.	CL, CH	A-7	0-5	80-100	70-95	65-90	50-85	40-60	20-35
	34-38	Weathered bedrock	---	---	---	---	---	---	---	---	---
207B, 207C------- Whalan	0-11	Loam-------------	ML	A-4	0	100	95-100	85-95	60-90	30-40	5-10
	11-21	Clay loam, loam	CL	A-6	0	95-100	95-100	80-95	70-90	30-40	10-15
	21-24	Clay loam, clay, silty clay.	CL, CH	A-7	0-5	80-100	70-95	65-90	50-85	40-60	20-35
	24-28	Weathered bedrock	---	---	---	---	---	---	---	---	---
213B------------- Rockton	0-16	Loam-------------	ML, CL-ML, CL	A-4	0	90-100	90-100	85-95	50-75	25-35	5-10
	16-32	Loam, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	90-100	90-100	75-90	45-70	30-45	10-20
	32-39	Clay, clay loam, silty clay.	CH, CL	A-7	0-2	90-100	90-100	90-95	70-90	40-60	20-35
	39-43	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
214B------------ Rockton	0-16	Loam------------	ML, CL-ML, CL	A-4	0	90-100	90-100	85-95	50-75	25-35	5-10
	16-25	Loam, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	90-100	90-100	75-90	45-70	30-45	10-20
	25-28	Clay, clay loam, silty clay.	CH, CL	A-7	0-2	90-100	90-100	90-95	70-90	40-60	20-35
	28-32	Weathered bedrock	---	---	---	---	---	---	---	---	---
215C------------ Goss	0-4	Loam------------	ML, CL, CL-ML	A-4	0-10	65-90	65-90	65-90	65-85	20-30	2-8
	4-18	Very cherty silty clay loam, very cherty silt loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-8
	18-60	Cherty silty clay loam, cherty silty clay, cherty clay.	GC	A-7	10-45	45-70	40-65	40-50	35-45	50-70	30-40
221------------- Palms	0-47	Sapric material	PT	A-8	---	---	---	---	---	---	---
	47-60	Clay loam, silt loam, fine sandy loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
225------------- Lawler	0-17	Loam------------	CL, ML	A-6, A-7	0	100	90-100	70-90	55-75	35-45	10-20
	17-28	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0-5	85-95	80-95	70-85	45-65	25-40	10-20
	28-60	Gravelly coarse sand, gravelly loamy sand, loamy coarse sand.	SW, GP, SP, SW-SM	A-1	2-10	50-90	50-85	20-40	3-10	---	NP
226------------- Lawler	0-17	Loam------------	CL, ML	A-6, A-7	0	100	90-100	70-90	55-75	35-45	10-20
	17-34	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0-5	85-95	80-95	70-85	45-65	25-40	10-20
	34-60	Gravelly coarse sand, gravelly loamy sand, loamy coarse sand.	SW, GP, SP, SW-SM	A-1	2-10	50-90	50-85	20-40	3-10	---	NP
241B*:											
Burkhardt-------	0-17	Sandy loam-------	SM, SM-SC	A-2, A-4	0	95-100	90-100	55-70	25-40	<26	2-7
	17-22	Sandy loam, loamy sand.	SM, ML, SC, CL	A-2, A-4	0	95-100	85-100	50-95	25-75	15-30	2-10
	22-60	Stratified sand to gravel.	SP, GP	A-1	0	50-85	45-85	20-35	1-5	---	NP
Saude-----------	0-13	Loam-------------	CL	A-6	0	100	90-100	70-90	50-75	25-35	10-15
	13-29	Loam, sandy loam	CL, SC, CL-ML, SM-SC	A-4, A-6	0-5	85-95	80-95	70-85	45-60	20-30	5-15
	29-60	Loamy sand, gravelly coarse sand, sand.	SW, SM, GP, GM	A-1	2-10	50-90	50-85	20-40	3-25	---	NP
284, 284B-------- Flagler	0-20	Fine sandy loam	SC, SM-SC	A-2, A-4	0	95-100	90-95	60-70	25-40	15-25	5-10
	20-30	Sandy loam-------	SC, SM-SC	A-2, A-4	0	95-100	90-95	50-70	25-40	15-25	5-10
	30-60	Loamy sand, gravelly sand, coarse sand.	SP-SM, SW, SP, SW-SM	A-1	0-5	70-90	70-85	20-40	3-12	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
285B------------- Burkhardt	0-17	Sandy loam-------	SM, SM-SC	A-2, A-4	0	95-100	90-100	55-70	25-40	<26	2-7
	17-22	Sandy loam, loamy sand.	SM, ML, SC, CL	A-2, A-4	0	95-100	85-100	50-95	25-75	15-30	2-10
	22-60	Stratified sand to gravel.	SP, GP	A-1	0	50-85	45-85	20-35	1-5	---	NP
302B------------- Coggon	0-20	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	90-95	65-85	20-30	5-15
	20-50	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	10-20
	50-60	Loam-------------	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	10-20
323B------------- Terril	0-31	Loam-------------	CL	A-4, A-6	0-5	100	95-100	70-90	60-80	25-40	8-15
	31-39	Loam, clay loam, sandy loam.	CL	A-4, A-6	0-5	100	90-100	70-90	60-80	25-40	8-15
	39-60	Sand, gravelly sand.	SP-SM, SM	A-2-4	0-25	90-100	75-90	60-80	10-35	---	NP
353B------------- Tell	0-11	Silt loam--------	CL	A-4	0	100	100	90-100	85-95	25-30	7-10
	11-26	Silty clay loam, silt loam.	CL	A-6	0	100	100	90-100	85-95	30-40	10-16
	26-30	Loam, sandy loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-2	0	100	90-100	55-95	25-75	20-35	4-14
	30-60	Sand, loamy sand	SM, SP-SM, SP	A-2, A-3, A-1	0	100	90-100	45-75	0-30	---	NP
377B, 377C, 377C2----------- Dinsdale	0-13	Silt loam--------	ML, CL	A-6, A-7	0	100	100	100	95-100	30-50	10-20
	13-27	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	27-60	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
391B*:											
Clyde-----------	0-23	Clay loam--------	OL, MH, ML, OH	A-7	0-5	95-100	95-100	80-90	55-75	45-60	15-25
	23-34	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	90-95	75-90	50-75	30-50	10-20
	34-41	Sandy loam, loam, sandy clay loam.	SM, SM-SC	A-2	2-5	80-95	75-90	50-80	15-35	15-20	NP-5
	41-60	Loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-90	45-65	25-35	10-20
Floyd-----------	0-22	Loam-------------	OL, ML, CL	A-4, A-6	0	100	100	80-90	55-75	30-40	5-15
	22-30	Sandy clay loam, loam.	CL	A-6	2-8	90-95	70-80	50-70	50-65	25-35	11-20
	30-36	Sandy loam, loamy sand.	SM, SM-SC	A-2	2-5	90-95	70-80	50-70	15-35	10-20	NP-5
	36-60	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-35	11-20
399-------------- Readlyn	0-23	Loam-------------	CL	A-6	0	100	100	85-95	55-75	30-40	15-25
	23-49	Loam, clay loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	30-40	10-20
	49-60	Loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	25-35	10-20
407B------------- Schley	0-18	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	80-90	55-75	25-40	5-15
	18-36	Loam, sandy loam, silty clay loam.	CL, SC, SM-SC, CL-ML	A-2, A-4	2-8	90-95	70-80	50-70	20-60	20-30	5-10
	36-60	Loam, sandy clay loam, clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-40	10-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
408B, 408C------- Olin	0-28	Fine sandy loam, sandy loam.	SM-SC, SC	A-2, A-4	0	100	95-100	85-95	30-50	20-30	5-10
	28-46	Loam, clay loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-95	80-90	45-65	25-35	10-20
	46-60	Loam, clay loam	CL	A-6	2-5	90-95	85-95	80-90	50-65	25-35	10-20
412C------------- Sogn	0-16	Loam-------------	CL, SC	A-6	0-10	85-100	75-100	65-100	45-95	25-40	11-23
	16-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
426B, 426C------- Aredale	0-16	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-95	55-75	25-35	5-15
	16-38	Loam, clay loam, fine sandy loam.	CL, SC	A-6	0-5	100	100	80-90	45-70	30-40	10-20
	38-55	Sandy loam, loamy fine sand.	SC, SM, SM-SC	A-2, A-4	0-5	100	100	70-90	20-50	<25	NP-10
	55-60	Loam-------------	CL	A-6	2-5	90-95	85-95	80-90	50-65	25-35	11-20
428B------------- Ely	0-26	Silty clay loam	CL, OL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	26-49	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
	49-60	Silt loam, silty clay loam, loam.	CL	A-6	0	100	100	90-100	85-100	25-40	10-20
468B, 468C------- Olin Variant	0-24	Sandy loam-------	SM-SC, SC	A-2, A-4	0	100	95-100	85-95	30-50	20-30	5-10
	24-44	Loam, clay loam	CL, SC	A-6	2-5	90-95	85-95	80-90	45-65	25-35	10-20
	44-60	Loam, clay loam	CL	A-6	2-5	90-95	85-95	80-90	50-65	25-35	10-20
471-------------- Oran	0-20	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	85-95	55-75	25-35	5-15
	20-49	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	10-20
	49-60	Loam-------------	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	10-20
478G*: Nordness---------	0-8	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	5-10
	8-14	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	90-100	70-90	35-45	15-25
	14-18	Silty clay loam, silty clay.	CL, CH	A-7	2-10	85-95	80-90	70-85	65-85	45-60	30-40
	18-22	Unweathered bedrock, weathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
485-------------- Spillville	0-51	Loam-------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	51-60	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SM-SC, SC	A-6, A-4	0	100	95-100	80-90	35-75	20-40	5-15
488C2, 488D2----- Newvienna	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	7-34	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	34-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	11-20
489-------------- Ossian	0-16	Silt loam--------	ML, CL, OL	A-6, A-7	0	100	100	100	95-100	35-50	10-25
	16-60	Silt loam, silty clay loam.	CL	A-6	0	100	100	100	95-100	30-40	10-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
499B, 499D, 499F- Nordness	0-8	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	5-10
	8-14	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	90-100	70-90	35-45	15-25
	14-18	Silty clay loam, silty clay.	CL, CH	A-7	2-10	85-95	80-90	70-85	65-85	45-60	30-40
	18-22	Unweathered bedrock, weathered bedrock.	---	---	---	---	---	---	---	---	---
585*:											
Spillville------	0-51	Loam-------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	51-60	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SM-SC, SC	A-6, A-4	0	100	95-100	80-90	35-75	20-40	5-15
Coland----------	0-38	Clay loam--------	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	38-47	Clay loam, silty clay loam.	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	47-60	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
663D2, 663E2, 663E3----------- Seaton	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-35	5-15
	6-52	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	90-100	25-40	5-20
	52-60	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	100	90-100	25-40	5-20
725-------------- Hayfield	0-12	Loam-------------	CL-ML, CL	A-6, A-4	0	100	100	90-98	70-90	25-40	6-15
	12-31	Loam, silt loam, clay loam.	CL-ML, CL	A-4, A-6	0	95-100	90-100	70-90	65-80	25-40	6-15
	31-60	Stratified loamy sand and gravel.	SP, SP-SM	A-1	0-3	85-100	50-98	25-50	0-15	---	NP
763E2, 763F2----- Exette	0-8	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	100	95-100	25-35	5-10
	8-32	Silt loam--------	ML, CL	A-6, A-4	0	100	100	100	95-100	30-40	7-15
	32-60	Silt loam--------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	7-15
771B, 771C------- Waubeek	0-11	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	100	25-35	5-15
	11-22	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	100	40-50	15-25
	22-60	Loam, sandy clay loam, clay loam.	CL	A-6	0-5	90-95	85-95	75-85	50-65	25-35	10-20
776, 776C-------- Lilah	0-12	Sandy loam-------	SM-SC, SC	A-2, A-4	0-5	90-95	80-90	60-70	25-40	<25	5-10
	12-27	Sandy loam, gravelly sandy loam.	SM, SM-SC, SC	A-2-4, A-1-b	0-5	80-95	60-90	40-60	15-30	<25	3-10
	27-39	Gravelly loamy sand, sand, gravelly sand.	SW, SW-SM, SP, SP-SM	A-1-b	0-10	70-90	50-90	30-50	3-12	---	NP
	39-60	Loamy sand, gravelly loamy sand, sand.	GP, SP, GP-GM, SP-SM	A-1-b	0-10	50-100	40-100	30-50	3-12	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
777------------- Wapsie	0-11	Loam-------------	CL, ML, CL-ML	A-4	0	100	90-100	70-90	50-75	25-35	5-10
	11-29	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	85-95	80-95	70-85	40-60	20-35	5-15
	29-60	Gravelly loamy sand, gravelly sand, sand.	SW, SM, SP, SP-SM	A-1	0	60-90	60-85	20-40	3-25	---	NP
781B------------ Lourdes	0-7	Loam-------------	CL, ML	A-6, A-7	0	100	100	90-95	65-80	35-45	10-20
	7-17	Loam, clay loam	CL	A-6	0	100	95-100	80-90	50-70	30-40	10-20
	17-54	Clay loam--------	CL	A-6	2-5	90-95	85-95	80-90	55-70	35-40	15-20
	54-60	Clay loam--------	CL	A-6	2-5	90-95	85-95	80-90	55-70	35-40	15-20
782B------------ Donnan	0-12	Loam-------------	CL, ML	A-4, A-6	0	100	100	85-95	65-80	30-40	5-15
	12-28	Clay loam, silty clay loam, loam.	CL	A-6	0-5	95-100	90-95	80-90	60-75	30-40	10-20
	28-60	Clay, silty clay	CH	A-7	0-5	95-100	90-95	80-90	60-75	55-70	30-40
793------------- Bertrand	0-13	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-90	25-35	6-15
	13-28	Silt loam, silty clay loam.	CL	A-6, A-4	0	100	100	90-100	85-95	25-40	7-20
	28-47	Silty clay loam, silt loam.	ML, SM, CL, SC	A-4	0	100	100	80-95	35-75	<30	4-10
	47-60	Stratified silt loam and loam.	SP-SM, SM	A-2, A-3	0	95-100	95-100	85-95	65-80	30-40	4-10
798B------------ Protivin	0-14	Loam-------------	MH, OH, OL, ML	A-7	0	100	100	85-95	60-75	45-55	15-20
	14-22	Loam, silt loam, silty clay loam.	CL	A-6	2-5	90-95	85-90	75-85	55-65	35-40	15-20
	22-60	Clay loam--------	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	15-25
809B, 809C------- Bertram	0-20	Fine sandy loam	SM-SC, SC, SM	A-2, A-4	0	100	95-100	85-95	30-50	25-35	5-10
	20-29	Sandy loam, fine sandy loam.	SM-SC, SC	A-2, A-4	0	100	95-100	80-90	25-40	15-25	5-10
	29-34	Sandy clay loam, clay loam.	SC, CL	A-6, A-7	0	85-95	80-90	70-80	45-65	35-45	20-30
	34-38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
826------------- Rowley	0-15	Silt loam--------	CL	A-4, A-6	0	100	100	90-100	70-95	25-35	8-13
	15-43	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-50	10-25
	43-52	Stratified silt loam to sand.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	100	100	80-100	35-75	20-30	4-11
	52-60	Sand, fine sand, silt loam.	SM, SP-SM	A-2, A-3	0	100	100	50-90	5-35	---	NP
883B------------ Cresken	0-20	Clay loam--------	CL	A-6	0	100	95-100	85-95	65-75	30-40	10-20
	20-45	Clay loam--------	CL	A-6	0-5	90-95	85-90	80-90	50-65	30-40	10-20
	45-60	Loam, clay loam	CL	A-6	0-5	90-95	85-90	80-90	50-65	30-40	15-25
907B------------ Schley	0-12	Loam-------------	CL-ML, CL	A-4, A-6	0	100	100	80-90	55-75	25-40	5-15
	12-29	Loam-------------	CL	A-6	0	95-100	95-100	60-70	50-65	25-40	10-20
	29-49	Sandy loam-------	SM-SC, SM	A-2-4	0	95-100	80-90	50-70	15-30	<20	NP-5
	49-60	Loamy sand, sand	SM, SP-SM	A-2	0	95-100	80-90	50-70	10-25	---	NP
933B------------ Sawmill	0-23	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	30-50	15-30
	23-33	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	30-50	15-30
	33-41	Silty clay loam, clay loam, loam.	CL	A-6, A-7, A-4	0	100	100	85-100	70-95	25-50	8-25
	41-60	Silty clay loam, clay loam, silt loam.	CL	A-4, A-6, A-7	0	100	100	75-100	65-95	20-50	8-30

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
977-------------- Richwood	0-21	Silt loam--------	ML	A-4	0	100	100	90-100	85-95	25-35	3-10
	21-39	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	85-95	20-35	5-15
	39-46	Stratified silt loam to loamy sand.	CL, ML, SC, SM	A-4	0	100	100	85-95	35-75	<25	2-10
	46-60	Fine sand, sand, silt loam.	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-35	---	NP
981, 981B-------- Worthen	0-39	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	80-100	25-40	7-21
	39-60	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	80-100	25-40	7-21
1485------------- Spillville	0-51	Loam-------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	51-60	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SM-SC, SC	A-6, A-4	0	100	95-100	80-90	35-75	20-40	5-15
1585*:											
Spillville------	0-51	Loam-------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	51-60	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SM-SC, SC	A-6, A-4	0	100	95-100	80-90	35-75	20-40	5-15
Coland----------	0-38	Clay loam--------	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	38-47	Clay loam, silty clay loam.	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	47-60	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
5010*, 5030*. Pits											
5040*. Orthents											
5042*. Udorthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
11B*:										
Colo-------------	0-18	20-26	1.25-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.28	5	6
	18-47	30-37	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	High---------	0.28		
	47-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.28		
Ely--------------	0-26	25-30	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7
	26-49	28-35	1.30-1.40	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.43		
	49-60	20-30	1.40-1.45	0.6-2.0	0.18-0.20	6.6-8.4	Moderate-----	0.43		
41, 41B, 41C----- Sparta	0-17	3-10	1.20-1.40	2.0-6.0	0.09-0.12	5.1-7.3	Low----------	0.17	5	2
	17-44	1-8	1.40-1.60	6.0-20	0.05-0.11	5.1-6.5	Low----------	0.17		
	44-60	0-5	1.50-1.70	6.0-20	0.04-0.07	5.1-6.0	Low----------	0.17		
63B, 63C, 63D, 63E------------- Chelsea	0-37	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	Low----------	0.17	5	2
	37-60	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-5.5	Low----------	0.17		
65D2------------- Lindley	0-7	18-27	1.20-1.40	0.6-2.0	0.16-0.18	4.5-7.3	Low----------	0.32	5	6
	7-43	25-35	1.40-1.60	0.2-0.6	0.14-0.18	4.5-6.5	Moderate-----	0.32		
	43-60	18-32	1.45-1.65	0.2-0.6	0.12-0.16	6.1-7.8	Moderate-----	0.32		
65E3------------- Lindley	0-7	27-35	1.30-1.40	0.2-0.6	0.14-0.18	4.5-7.3	Moderate-----	0.32	4	6
	7-43	25-35	1.40-1.60	0.2-0.6	0.14-0.18	4.5-6.5	Moderate-----	0.32		
	43-60	18-32	1.45-1.65	0.2-0.6	0.12-0.16	6.1-7.8	Moderate-----	0.32		
83B, 83C, 83C2--- Kenyon	0-17	20-25	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.28	5	6
	17-54	20-30	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.28		
	54-60	20-24	1.65-1.80	0.6-2.0	0.17-0.19	6.6-8.4	Low----------	0.37		
84--------------- Clyde	0-23	28-32	1.35-1.40	0.6-2.0	0.21-0.23	6.1-7.3	Moderate-----	0.28	5	7
	23-34	22-28	1.45-1.65	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.37		
	34-41	10-22	1.60-1.70	2.0-6.0	0.11-0.13	6.1-7.3	Low----------	0.37		
	41-60	20-24	1.70-1.80	0.6-2.0	0.17-0.19	6.6-8.4	Moderate-----	0.37		
109B, 109C------- Backbone	0-12	8-18	1.50-1.55	2.0-6.0	0.12-0.14	5.6-7.3	Low----------	0.24	4	3
	12-29	12-18	1.55-1.65	2.0-6.0	0.11-0.13	5.1-7.3	Low----------	0.24		
	29-32	32-42	1.65-1.80	0.2-0.6	0.14-0.16	5.6-7.3	High---------	0.24		
	32-36	---	---	---	---	---	-------------	----		
110B, 110C------- Lamont	0-5	10-15	1.50-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low----------	0.24	5	3
	5-11	5-15	1.50-1.55	2.0-6.0	0.14-0.16	5.1-7.3	Low----------	0.24		
	11-31	10-22	1.45-1.65	2.0-6.0	0.14-0.16	5.1-6.0	Low----------	0.24		
	31-60	2-12	1.65-1.75	6.0-20	0.09-0.11	5.1-6.5	Low----------	0.17		
119-------------- Muscatine	0-22	24-27	1.28-1.32	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.28	5	6
	22-43	30-35	1.28-1.35	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.43		
	43-60	22-30	1.35-1.40	0.6-2.0	0.18-0.20	6.6-7.8	Moderate-----	0.43		
120B, 120C------- Tama	0-20	24-29	1.25-1.30	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.32	5	7
	20-40	27-35	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	40-60	20-28	1.35-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43		
129B*:										
Arenzville-------	0-25	10-18	1.20-1.55	0.6-2.0	0.20-0.24	5.6-7.8	Low----------	0.37	5	5
	25-35	10-30	1.25-1.45	0.6-2.0	0.18-0.22	5.6-7.8	Moderate-----	0.37		
	35-60	5-20	1.20-1.40	0.6-2.0	0.12-0.16	5.6-7.8	Low----------	0.37		
Chaseburg--------	0-8	12-16	1.35-1.55	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.37	5	5
	8-60	10-18	1.55-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Low----------	0.37		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
133+------------- Colo	0-18	20-26	1.25-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.28	5	6
	18-47	30-37	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	High---------	0.28		
	47-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.28		
151-------------- Marshan	0-22	27-35	1.30-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	4	7
	22-30	25-35	1.40-1.55	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.28		
	30-35	18-30	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low----------	0.28		
	35-60	<5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.3	Low----------	0.15		
152-------------- Marshan	0-22	27-35	1.30-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	4	7
	22-34	25-35	1.40-1.55	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.28		
	34-38	18-30	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low----------	0.28		
	38-60	<5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.3	Low----------	0.15		
153-------------- Marshan	0-15	27-35	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	4	7
	15-19	25-35	1.40-1.55	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.28		
	19-29	18-30	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low----------	0.28		
	29-60	<5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.3	Low----------	0.15		
158-------------- Dorchester	0-5	18-24	1.20-1.30	0.6-2.0	0.20-0.22	7.9-8.4	Low----------	0.37	5	6
	5-60	18-30	1.25-1.40	0.6-2.0	0.22-0.24	6.6-7.8	Moderate-----	0.37		
159, 159C-------- Finchford	0-14	5-10	1.50-1.55	>6.0	0.10-0.12	6.1-7.3	Low----------	0.17	5	2
	14-29	2-8	1.50-1.60	>20	0.04-0.06	5.1-6.0	Low----------	0.17		
	29-60	2-5	1.60-1.70	>20	0.02-0.04	5.6-6.5	Low----------	0.17		
162B, 162C, 162C2, 162D, 162D2----------- Downs	0-18	18-24	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Low----------	0.32	5	6
	18-44	26-35	1.30-1.35	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.43		
	44-60	22-26	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43		
163C, 163C2, 163D, 163D2----- Fayette	0-12	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	12-46	21-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	46-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
163D3------------ Fayette	0-12	27-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37	4	7
	12-46	21-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	46-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
163E, 163E2------ Fayette	0-12	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	12-46	21-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	46-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
163E3------------ Fayette	0-12	27-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37	4	7
	12-46	21-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	46-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
163F, 163F2------ Fayette	0-12	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	12-46	21-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	46-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
163F3------------ Fayette	0-12	27-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37	4	7
	12-46	21-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	46-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
163G------------- Fayette	0-12	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	12-46	21-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	46-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
171B, 171C2------ Bassett	0-20	18-25	1.45-1.50	0.6-2.0	0.19-0.21	4.5-6.5	Low----------	0.28	5	6
	20-42	20-28	1.55-1.65	0.6-2.0	0.17-0.19	4.5-5.5	Low----------	0.28		
	42-60	20-24	1.65-1.80	0.6-2.0	0.17-0.19	5.1-8.4	Low----------	0.37		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	g/cc	In/hr	In/in	pH				
174B, 174C------- Bolan	0-20	20-26	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	6
	20-28	12-20	1.45-1.50	0.6-2.0	0.17-0.19	5.6-6.5	Low-----------	0.28		
	28-41	10-16	1.50-1.60	2.0-6.0	0.11-0.13	6.1-7.3	Low-----------	0.28		
	41-60	2-8	1.60-1.70	6.0-20	0.08-0.10	6.1-7.3	Low-----------	0.17		
175, 175B, 175C-- Dickinson	0-7	10-18	1.50-1.55	2.0-6.0	0.12-0.15	5.6-7.3	Low-----------	0.20	4	3
	7-28	10-15	1.45-1.55	2.0-6.0	0.12-0.15	5.1-6.5	Low-----------	0.20		
	28-40	4-10	1.55-1.65	6.0-20	0.08-0.10	5.1-6.5	Low-----------	0.20		
	40-60	4-10	1.60-1.70	6.0-20	0.02-0.04	5.6-7.3	Low-----------	0.15		
177, 177B-------- Saude	0-13	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	6
	13-29	12-18	1.40-1.50	0.6-6.0	0.15-0.19	5.1-6.0	Low-----------	0.28		
	29-60	2-8	1.50-1.75	>20	0.02-0.06	5.1-6.5	Low-----------	0.10		
178, 178B-------- Waukee	0-21	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.24	4	6
	21-35	18-27	1.40-1.50	0.6-2.0	0.15-0.19	5.1-6.0	Low-----------	0.24		
	35-60	2-8	1.50-1.75	>20	0.02-0.06	5.6-6.5	Low-----------	0.10		
183C, 183E------- Dubuque	0-12	18-30	1.30-1.35	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37	4	6
	12-23	26-35	1.30-1.45	0.6-2.0	0.18-0.20	5.6-6.0	Moderate-----	0.37		
	23-28	40-55	1.50-1.70	0.06-0.2	0.12-0.15	5.6-6.0	High----------	0.37		
	28-32	---	---	---	---	---	-------------	----		
198B------------- Floyd	0-22	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.24	5	6
	22-30	18-24	1.40-1.60	0.6-2.0	0.16-0.18	6.1-7.3	Low-----------	0.32		
	30-36	6-12	1.60-1.65	2.0-6.0	0.11-0.13	6.6-7.3	Low-----------	0.32		
	36-60	18-30	1.65-1.80	0.6-2.0	0.16-0.18	6.6-8.4	Low-----------	0.32		
205B------------- Whalan	0-11	18-25	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	4	6
	11-30	18-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Low-----------	0.32		
	30-34	35-60	1.35-1.45	0.06-0.6	0.15-0.19	5.6-7.8	High----------	0.32		
	34-38	---	---	---	---	---	-------------	----		
207B, 207C------- Whalan	0-11	18-25	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	4	6
	11-21	18-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Low-----------	0.32		
	21-24	35-60	1.35-1.45	0.06-0.6	0.15-0.19	5.6-7.8	High----------	0.32		
	24-28	---	---	---	---	---	-------------	----		
213B------------- Rockton	0-16	18-28	1.30-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Low-----------	0.28	4	6
	16-32	25-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Moderate-----	0.28		
	32-39	35-60	1.35-1.45	0.6-2.0	0.10-0.14	5.6-7.3	High----------	0.28		
	39-43	---	---	---	---	---	-------------	----		
214B------------- Rockton	0-16	18-28	1.30-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Low-----------	0.28	4	6
	16-25	25-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Moderate-----	0.28		
	25-28	35-60	1.35-1.45	0.6-2.0	0.10-0.14	5.6-7.3	High----------	0.28		
	28-32	---	---	---	---	---	-------------	----		
215C------------- Goss	0-4	7-27	1.10-1.30	2.0-6.0	0.06-0.17	4.5-6.0	Low-----------	0.24	2	6
	4-18	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low-----------	0.10		
	18-60	35-60	1.30-1.50	0.6-2.0	0.04-0.09	4.5-6.0	Moderate-----	0.10		
221-------------- Palms	0-47	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-7.8	-------------	----	2	2
	47-60	7-35	1.45-1.75	0.2-2.0	0.14-0.22	6.1-8.4	Low-----------	----		
225-------------- Lawler	0-17	18-28	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	6
	17-28	20-28	1.45-1.60	0.6-2.0	0.16-0.18	5.1-6.5	Low-----------	0.28		
	28-60	2-12	1.60-1.75	>20	0.02-0.04	5.1-7.3	Low-----------	0.10		
226-------------- Lawler	0-17	18-28	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	6
	17-34	20-28	1.45-1.60	0.6-2.0	0.16-0.18	5.1-6.5	Low-----------	0.28		
	34-60	2-12	1.60-1.75	>20	0.02-0.04	5.1-7.3	Low-----------	0.10		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
241B*:										
Burkhardt	0-17	5-13	1.35-1.55	2.0-6.0	0.11-0.15	5.1-6.5	Low	0.20	3	3
	17-22	8-18	1.55-1.65	2.0-6.0	0.10-0.19	5.1-6.5	Low	0.24		
	22-60	1-6	1.50-1.60	>6.0	0.02-0.04	5.6-6.5	Low	0.10		
Saude	0-13	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.28	4	6
	13-29	12-18	1.40-1.50	0.6-6.0	0.15-0.19	5.1-6.0	Low	0.28		
	29-60	2-8	1.50-1.75	>20	0.02-0.06	5.1-6.5	Low	0.10		
284, 284B Flagler	0-20	12-18	1.50-1.55	2.0-6.0	0.12-0.14	5.6-7.3	Low	0.20	4	3
	20-30	10-15	1.55-1.60	2.0-6.0	0.11-0.13	5.1-6.5	Low	0.20		
	30-60	2-8	1.60-1.75	>20	0.02-0.04	5.1-7.3	Low	0.20		
285B Burkhardt	0-17	5-13	1.35-1.55	2.0-6.0	0.11-0.15	5.1-6.5	Low	0.20	3	3
	17-22	8-18	1.55-1.65	2.0-6.0	0.10-0.19	5.1-6.5	Low	0.24		
	22-60	1-6	1.50-1.60	>6.0	0.02-0.04	5.6-6.5	Low	0.10		
302B Coggon	0-20	20-24	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Low	0.32	5	6
	20-50	22-28	1.50-1.70	0.6-2.0	0.17-0.19	4.5-6.0	Low	0.32		
	50-60	18-24	1.70-1.80	0.6-2.0	0.17-0.19	5.1-7.8	Low	0.32		
323B Terril	0-31	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low	0.32	5	6
	31-39	22-30	1.40-1.65	0.6-2.0	0.16-0.18	6.1-7.3	Low	0.32		
	39-60	2-8	1.65-1.75	6.0-20	0.05-0.07	6.1-8.4	Low	0.10		
353B Tell	0-11	14-18	1.35-1.45	0.6-2.0	0.22-0.24	5.1-6.5	Low	0.37	4	5
	11-26	20-28	1.50-1.60	0.6-2.0	0.18-0.22	5.1-6.5	Moderate	0.37		
	26-30	10-25	1.50-1.60	0.6-2.0	0.11-0.19	5.1-6.5	Low	0.37		
	30-60	2-8	1.55-1.70	6.0-20	0.04-0.07	5.1-6.5	Low	0.15		
377B, 377C, 377C2 Dinsdale	0-13	25-29	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Moderate	0.32	5	7
	13-27	30-34	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.0	Moderate	0.43		
	27-60	20-30	1.65-1.80	0.6-2.0	0.17-0.19	5.6-8.4	Low	0.43		
391B*:										
Clyde	0-23	28-32	1.35-1.40	0.6-2.0	0.21-0.23	6.1-7.3	Moderate	0.28	5	7
	23-34	22-28	1.45-1.65	0.6-2.0	0.18-0.20	6.1-7.3	Moderate	0.37		
	34-41	10-22	1.60-1.70	2.0-6.0	0.11-0.13	6.1-7.3	Low	0.37		
	41-60	20-24	1.70-1.80	0.6-2.0	0.17-0.19	6.6-8.4	Moderate	0.37		
Floyd	0-22	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate	0.24	5	6
	22-30	18-24	1.40-1.60	0.6-2.0	0.16-0.18	6.1-7.3	Low	0.32		
	30-36	6-12	1.60-1.65	2.0-6.0	0.11-0.13	6.6-7.3	Low	0.32		
	36-60	18-30	1.65-1.80	0.6-2.0	0.16-0.18	6.6-8.4	Low	0.32		
399 Readlyn	0-23	18-24	1.35-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low	0.24	5	6
	23-49	22-28	1.45-1.70	0.6-2.0	0.17-0.19	5.1-6.5	Low	0.32		
	49-60	18-24	1.70-1.80	0.6-2.0	0.17-0.19	6.6-7.8	Low	0.32		
407B Schley	0-18	18-22	1.40-1.45	0.6-2.0	0.19-0.21	4.5-6.5	Moderate	0.32	5	6
	18-36	15-28	1.45-1.65	0.6-2.0	0.12-0.16	4.5-5.5	Low	0.32		
	36-60	20-28	1.65-1.80	0.6-2.0	0.16-0.18	5.1-7.8	Low	0.32		
408B, 408C Olin	0-28	12-18	1.45-1.50	2.0-6.0	0.13-0.15	5.6-7.3	Low	0.20	5	3
	28-46	20-28	1.50-1.70	0.6-2.0	0.17-0.19	5.1-6.0	Low	0.32		
	46-60	20-28	1.70-1.80	0.6-2.0	0.17-0.19	7.4-8.4	Low	0.32		
412C Sogn	0-16	18-25	1.15-1.20	0.6-2.0	0.17-0.22	6.1-8.4	Moderate	0.32	1	4L
	16-20	---	---	---	---	---	-------------	----		
426B, 426C Aredale	0-16	18-25	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.28	5	6
	16-38	18-28	1.45-1.65	0.6-2.0	0.17-0.19	5.1-6.0	Low	0.28		
	38-55	8-15	1.60-1.70	2.0-6.0	0.11-0.13	5.1-6.0	Low	0.28		
	55-60	18-24	1.70-1.80	0.6-2.0	0.17-0.19	5.6-7.3	Low	0.37		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
428B------------- Ely	0-26	25-30	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7
	26-49	28-35	1.30-1.40	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.43		
	49-60	20-30	1.40-1.45	0.6-2.0	0.18-0.20	6.6-8.4	Moderate-----	0.43		
468B, 468C------- Olin Variant	0-24	12-18	1.45-1.50	2.0-6.0	0.13-0.15	5.6-7.3	Low----------	0.20	5	3
	24-44	20-28	1.50-1.70	0.6-2.0	0.17-0.19	5.1-6.5	Low----------	0.32		
	44-60	20-28	1.70-1.80	0.6-2.0	0.17-0.19	5.6-6.5	Low----------	0.32		
471-------------- Oran	0-20	16-24	1.40-1.45	0.6-2.0	0.18-0.20	5.1-7.3	Low----------	0.28	5	6
	20-49	22-28	1.45-1.70	0.6-2.0	0.17-0.19	4.5-6.5	Low----------	0.28		
	49-60	20-26	1.70-1.80	0.6-2.0	0.17-0.19	7.4-7.8	Low----------	0.37		
478G*:										
Nordness--------	0-8	18-24	1.30-1.35	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43	2	6
	8-14	22-29	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.43		
	14-18	27-42	1.35-1.60	0.06-0.2	0.12-0.15	6.6-7.3	High---------	0.43		
	18-22	---	---	---	---	---	-------------	----		
Rock outcrop.										
485-------------- Spillville	0-51	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28	5	6
	51-60	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low----------	0.28		
488C2, 488D2----- Newvienna	0-7	18-27	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Low----------	0.32	5	6
	7-34	20-35	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
	34-60	15-25	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
489-------------- Ossian	0-16	22-27	1.25-1.30	0.6-2.0	0.22-0.24	6.6-7.3	Moderate-----	0.28	5	6
	16-60	20-30	1.30-1.40	0.6-2.0	0.20-0.22	6.6-7.8	Moderate-----	0.28		
499B, 499D, 499F- Nordness	0-8	18-24	1.30-1.35	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43	2	6
	8-14	22-29	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.43		
	14-18	27-35	1.35-1.60	0.06-0.2	0.12-0.15	6.6-7.3	High---------	0.43		
	18-22	---	---	---	---	---	-------------	----		
585*:										
Spillville------	0-51	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28	5	6
	51-60	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low----------	0.28		
Coland----------	0-38	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	High---------	0.28	5	7
	38-47	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	High---------	0.28		
	47-60	12-26	1.50-1.65	0.6-6.0	0.13-0.17	6.1-7.8	Low----------	0.28		
663D2, 663E2----- Seaton	0-6	15-22	1.10-1.20	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5-4	6
	6-52	18-27	1.15-1.30	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37		
	52-60	15-25	1.20-1.40	0.6-2.0	0.20-0.22	5.6-8.4	Low----------	0.37		
663E3------------ Seaton	0-6	15-22	1.10-1.20	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	6
	6-52	18-27	1.15-1.30	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37		
	52-60	15-25	1.20-1.40	0.6-2.0	0.20-0.22	5.6-8.4	Low----------	0.37		
725-------------- Hayfield	0-12	18-27	1.30-1.50	0.6-2.0	0.20-0.24	5.6-6.5	Low----------	0.32	5	6
	12-31	18-30	1.40-1.55	0.6-2.0	0.17-0.22	5.1-6.0	Low----------	0.32		
	31-60	<5	1.55-1.65	6.0-20	0.02-0.04	5.6-7.8	Low----------	0.15		
763E2, 763F2----- Exette	0-8	18-22	1.30-1.35	0.6-2.0	0.21-0.23	6.6-7.3	Low----------	0.37	5-4	6
	8-32	18-26	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.37		
	32-60	15-20	1.45-1.50	0.6-2.0	0.20-0.22	6.6-7.8	Moderate-----	0.37		
771B, 771C------- Waubeek	0-11	19-24	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5-4	6
	11-22	25-34	1.25-1.35	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	22-60	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.43		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	g/cc	In/hr	In/in	pH				
776, 776C-------- Lilah	0-12	5-13	1.50-1.55	2.0-6.0	0.11-0.13	5.1-6.0	Low----------	0.20	2	3
	12-27	10-15	1.55-1.65	2.0-6.0	0.10-0.12	4.5-6.0	Low----------	0.20		
	27-39	2-10	1.55-1.80	>20	0.02-0.04	4.5-6.0	Low----------	0.20		
	39-60	2-6	1.55-1.85	>20	0.02-0.04	4.5-6.0	Low----------	0.20		
777-------------- Wapsie	0-11	12-18	1.40-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Low----------	0.28	4	5
	11-29	12-18	1.45-1.50	0.6-2.0	0.15-0.17	5.6-6.0	Low----------	0.28		
	29-60	2-10	1.50-1.75	>20	0.02-0.06	5.1-7.3	Low----------	0.10		
781B------------- Lourdes	0-7	20-27	1.45-1.60	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.37	3-2	6
	7-17	20-33	1.45-1.60	0.6-2.0	0.16-0.18	4.5-5.5	Low----------	0.37		
	17-54	28-35	1.45-1.60	0.2-0.6	0.15-0.17	4.5-7.3	Moderate-----	0.37		
	54-60	28-33	1.60-1.85	0.2-0.6	0.15-0.17	7.4-7.8	Moderate-----	0.37		
782B------------- Donnan	0-12	20-26	1.45-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.28	4	6
	12-28	15-30	1.45-1.55	0.6-2.0	0.17-0.19	5.1-5.5	Moderate-----	0.28		
	28-60	42-55	1.65-1.80	<0.06	0.11-0.14	5.1-6.5	High---------	0.28		
793-------------- Bertrand	0-13	15-22	1.35-1.60	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	5
	13-28	18-30	1.55-1.65	0.6-2.0	0.18-0.22	5.1-6.5	Moderate-----	0.37		
	28-47	10-30	1.55-1.65	0.6-6.0	0.09-0.22	5.1-6.5	Low----------	0.37		
	47-60	1-22	1.55-1.65	0.6-20	0.05-0.09	5.1-6.5	Low----------	0.15		
798B------------- Protivin	0-14	20-30	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.28	5	6
	14-22	20-30	1.50-1.60	0.2-0.6	0.17-0.19	5.1-6.0	Moderate-----	0.37		
	22-60	25-35	1.60-1.90	0.2-0.6	0.15-0.17	6.1-7.8	Moderate-----	0.37		
809B, 809C------- Bertram	0-20	8-15	1.50-1.55	2.0-6.0	0.12-0.14	6.1-7.3	Low----------	0.20	4	3
	20-29	12-18	1.55-1.60	2.0-6.0	0.11-0.13	5.1-6.0	Low----------	0.20		
	29-34	20-32	1.60-1.80	0.2-0.6	0.14-0.16	5.6-7.8	Moderate-----	0.20		
	34-38	---	---	---	---	---	-------------	----		
826-------------- Rowley	0-15	15-22	1.35-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.28	5	5
	15-43	20-30	1.35-1.65	0.6-2.0	0.18-0.22	5.1-7.3	Low----------	0.43		
	43-52	10-20	1.55-1.65	0.6-2.0	0.12-0.16	5.1-7.3	Low----------	0.43		
	52-60	1-4	1.55-1.65	6.0-20	0.05-0.07	5.6-7.3	Low----------	0.15		
883B------------- Cresken	0-20	25-32	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	5	6
	20-45	28-33	1.50-1.60	0.2-0.6	0.17-0.19	5.1-6.5	Moderate-----	0.28		
	45-60	22-30	1.60-1.85	0.2-0.6	0.14-0.16	5.6-7.8	Moderate-----	0.37		
907B------------- Schley	0-12	18-22	1.40-1.45	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.32	5	6
	12-29	15-26	1.45-1.65	0.6-2.0	0.12-0.16	5.1-6.5	Moderate-----	0.32		
	29-49	8-12	1.50-1.65	2.0-6.0	0.11-0.13	5.1-6.5	Low----------	0.32		
	49-60	2-8	1.50-1.65	6.0-20	0.08-0.10	5.1-6.5	Low----------	0.17		
933B------------- Sawmill	0-23	27-35	1.20-1.40	0.6-2.0	0.21-0.23	6.1-7.8	Moderate-----	0.28	5	7
	23-33	27-35	1.20-1.40	0.6-2.0	0.21-0.23	6.1-7.8	Moderate-----	0.28		
	33-41	25-35	1.30-1.45	0.6-2.0	0.17-0.20	6.1-7.8	Moderate-----	0.28		
	41-60	18-35	1.35-1.50	0.6-2.0	0.15-0.19	7.4-8.4	Moderate-----	0.28		
977-------------- Richwood	0-21	15-22	1.35-1.60	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.28	5	5
	21-39	18-34	1.55-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Moderate-----	0.43		
	39-46	10-22	1.55-1.65	0.6-6.0	0.10-0.22	5.6-7.3	Low----------	0.43		
	46-60	1-22	1.55-1.65	0.6-20	0.05-0.07	6.1-7.3	Low----------	0.15		
981, 981B-------- Worthen	0-39	15-22	1.20-1.40	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6
	39-60	18-24	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.8	Low----------	0.43		
1485------------- Spillville	0-51	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28	5	6
	51-60	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low----------	0.28		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
1585*:										
Spillville------	0-51	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28	5	6
	51-60	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low----------	0.28		
Coland----------	0-38	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	High---------	0.28	5	7
	38-47	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	High---------	0.28		
	47-60	12-26	1.50-1.65	0.6-6.0	0.13-0.17	6.1-7.8	Low----------	0.28		
5010*, 5030*. Pits										
5040*. Orthents										
5042*. Udorthents										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
11B*:												
Colo-------------	B/D	Occasional	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
Ely--------------	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
41, 41B, 41C------ Sparta	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
63B, 63C, 63D, 63E-------------- Chelsea	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
65D2, 65E3-------- Lindley	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
83B, 83C, 83C2---- Kenyon	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
84--------------- Clyde	B/D	None--------	---	---	1.0-2.5	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
109B, 109C-------- Backbone	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Low------	Low.
110B, 110C-------- Lamont	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
119-------------- Muscatine	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
120B, 120C-------- Tama	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
129B*:												
Arenzville-------	B	Occasional	Brief-----	Nov-Jun	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
Chaseburg--------	B	Occasional	Very brief	Nov-Jun	3.0-6.0	Apparent	Nov-Apr	>60	---	High-----	Moderate	Moderate.
133+------------- Colo	B/D	Occasional	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
151, 152---------- Marshan	B/D	None--------	---	---	1.0-2.5	Apparent	Oct-Jun	>60	---	High-----	High-----	Moderate.
153-------------- Marshan	B/D	Rare--------	---	---	+2-1.0	Apparent	Jan-Dec	>60	---	High-----	High-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
158---------------- Dorchester	B	Frequent----	Very brief to brief.	Feb-Nov	>6.0	---	---	>60	---	High-----	High-----	Low.
159, 159C--------- Finchford	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
162B, 162C, 162C2, 162D, 162D2------ Downs	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
163C, 163C2, 163D, 163D2, 163D3, 163E, 163E2, 163E3, 163F, 163F2, 163F3, 163G------------- Fayette	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
171B, 171C2------- Bassett	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
174B, 174C-------- Bolan	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
175, 175B, 175C--- Dickinson	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
177, 177B--------- Saude	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
178, 178B--------- Waukee	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
183C, 183E-------- Dubuque	B	None--------	---	---	>6.0	---	---	20-30	Hard	High-----	Moderate	Moderate.
198B-------------- Floyd	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
205B, 207B, 207C-- Whalan	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate	Low.
213B, 214B-------- Rockton	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	Low------	Low.
215C-------------- Goss	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
221--------------- Palms	A/D	None--------	---	---	+1-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
225, 226 Lawler	B	None	---	---	2.0-4.0	Apparent	Nov-May	>60	---	High	High	Moderate.
241B*:												
Burkhardt	B	None	---	---	>6.0	---	---	>60	---	Low	Low	High.
Saude	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.
284, 284B Flagler	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
285B Burkhardt	B	None	---	---	>6.0	---	---	>60	---	Low	Low	High.
302B Coggon	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
323B Terril	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
353B Tell	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Moderate.
377B, 377C, 377C2 Dinsdale	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Moderate.
391B*:												
Clyde	B/D	None	---	---	1.0-2.5	Apparent	Nov-Jul	>60	---	High	High	Low.
Floyd	B	None	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	High	High	Low.
399 Readlyn	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
407B Schley	B	None	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	High.
408B, 408C Olin	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
412C Sogn	D	None	---	---	>6.0	---	---	4-20	Hard	Moderate	Low	Low.
426B, 426C Aredale	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
428B Ely	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
468B, 468C Olin Variant	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
471----------------- Oran	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
478G*:												
Nordness---------	B	None---------	---	---	>6.0	---	---	8-20	Hard	Low------	Low------	Low.
Rock outcrop.												
485----------------- Spillville	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High-----	Moderate.
488C2, 488D2------- Newvienna	B	None---------	---	---	2.5-4.0	Apparent	Mar-Jun	>60	---	High-----	Moderate	Moderate.
489----------------- Ossian	B/D	Occasional	Very brief	Feb-Nov	1.0-2.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
499B, 499D, 499F--- Nordness	B	None---------	---	---	>6.0	---	---	8-20	Hard	Low------	Low------	Low.
585*:												
Spillville--------	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High-----	Moderate.
Coland------------	B/D	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
663D2, 663E2, 663E3------------ Seaton	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.
725----------------- Hayfield	B	None---------	---	---	2.5-5.0	Apparent	Nov-Jun	>60	---	High-----	Low------	Moderate.
763E2, 763F2------- Exette	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Low.
771B, 771C--------- Waubeek	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
776, 776C---------- Lilah	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	High.
777----------------- Wapsie	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
781B---------------- Lourdes	C	None---------	---	---	3.0-5.0	Perched	Nov-Jul	>60	---	High-----	High-----	Moderate.
782B---------------- Donnan	C	None---------	---	---	2.0-3.0	Perched	Nov-Jul	>60	---	High-----	High-----	Moderate.
793----------------- Bertrand	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
798B-------------- Protivin	C	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
809B, 809C-------- Bertram	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Low------	Moderate.
826--------------- Rowley	C	Occasional	Brief-----	Mar-May	1.0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
883B-------------- Cresken	B	None--------	---	---	4.0-6.0	Perched	Nov-May	>60	---	Moderate	High-----	Moderate.
907B-------------- Schley	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
933B-------------- Sawmill	B/D	Occasional	Brief-----	Mar-Jun	0-2.0	Apparent	Mar-Jun	>60	---	High-----	High-----	Low.
977--------------- Richwood	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Low.
981, 981B--------- Worthen	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Low.
1485-------------- Spillville	B	Frequent----	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High-----	Moderate.
1585*:												
Spillville-------	B	Frequent----	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High-----	Moderate.
Coland-----------	B/D	Frequent----	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
5010*, 5030*. Pits												
5040*. Orthents												
5042*. Udorthents												

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Aredale	Fine-loamy, mixed, mesic Typic Hapludolls
Arenzville	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Backbone	Coarse-loamy, mixed, mesic Mollic Hapludalfs
Bassett	Fine-loamy, mixed, mesic Mollic Hapludalfs
Bertram	Coarse-loamy, mixed, mesic Typic Hapludolls
Bertrand	Fine-silty, mixed, mesic Typic Hapludalfs
Bolan	Coarse-loamy, mixed, mesic Typic Hapludolls
Burkhardt	Sandy, mixed, mesic Typic Hapludolls
Chaseburg	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Chelsea	Mixed, mesic Alfic Udipsamments
Clyde	Fine-loamy, mixed, mesic Typic Haplaquolls
Coggon	Fine-loamy, mixed, mesic Typic Hapludalfs
Coland	Fine-loamy, mixed, mesic Cumulic Haplaquolls
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Cresken	Fine-loamy, mixed, mesic Typic Hapludolls
Dickinson	Coarse-loamy, mixed, mesic Typic Hapludolls
Dinsdale	Fine-silty, mixed, mesic Typic Argiudolls
Donnan	Fine-loamy over clayey, mixed, mesic Aquollic Hapludalfs
Dorchester	Fine-silty, mixed (calcareous), mesic Typic Udifluvents
Downs	Fine-silty, mixed, mesic Mollic Hapludalfs
Dubuque	Fine-silty, mixed, mesic Typic Hapludalfs
Ely	Fine-silty, mixed, mesic Cumulic Hapludolls
Exette	Fine-silty, mixed, mesic Dystric Eutrochrepts
Fayette	Fine-silty, mixed, mesic Typic Hapludalfs
Finchford	Sandy, mixed, mesic Entic Hapludolls
Flagler	Coarse-loamy, mixed, mesic Typic Hapludolls
Floyd	Fine-loamy, mixed, mesic Aquic Hapludolls
Goss	Clayey-skeletal, mixed, mesic Typic Paleudalfs
Hayfield	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aquollic Hapludalfs
Kenyon	Fine-loamy, mixed, mesic Typic Hapludolls
Lamont	Coarse-loamy, mixed, mesic Typic Hapludalfs
Lawler	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aquic Hapludolls
Lilah	Sandy, mixed, mesic Psammentic Hapludalfs
Lindley	Fine-loamy, mixed, mesic Typic Hapludalfs
Lourdes	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Marshan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplaquolls
Muscatine	Fine-silty, mixed, mesic Aquic Hapludolls
Newvienna	Fine-silty, mixed, mesic Mollic Hapludalfs
Nordness	Loamy, mixed, mesic Lithic Hapludalfs
Olin	Coarse-loamy, mixed, mesic Typic Hapludolls
Olin Variant	Coarse-loamy, mixed, mesic Mollic Hapludalfs
Oran	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Orthents	Loamy, mixed, mesic Typic Udorthents
Ossian	Fine-silty, mixed, mesic Typic Haplaquolls
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Protivin	Fine-loamy, mixed, mesic Aquic Argiudolls
Readlyn	Fine-loamy, mixed, mesic Aquic Hapludolls
Richwood	Fine-silty, mixed, mesic Typic Argiudolls
Rockton	Fine-loamy, mixed, mesic Typic Argiudolls
Rowley	Fine-silty, mixed, mesic Aquic Argiudolls
Saude	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Sawmill	Fine-silty, mixed, mesic Cumulic Haplaquolls
Schley	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Seaton	Fine-silty, mixed, mesic Typic Hapludalfs
*Sogn	Loamy, mixed, mesic Lithic Haplustolls
Sparta	Sandy, mixed, mesic Entic Hapludolls
Spillville	Fine-loamy, mixed, mesic Cumulic Hapludolls
Tama	Fine-silty, mixed, mesic Typic Argiudolls
Tell	Fine-silty over sandy or sandy-skeletal, mixed, mesic Typic Hapludalfs
Terril	Fine-loamy, mixed, mesic Cumulic Hapludolls
Udorthents	Mixed, mesic Typic Udorthents
Wapsie	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Mollic Hapludalfs

TABLE 18.--CLASSIFICATION OF THE SOILS--Continued

Soil name	Family or higher taxonomic class
Waubeek	Fine-silty, mixed, mesic Mollic Hapludalfs
Waukee	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Whalan	Fine-loamy, mixed, mesic Typic Hapludalfs
Worthen	Fine-silty, mixed, mesic Cumulic Hapludolls

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