United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Missouri Agricultural
Experiment Station

Soil Survey of Saline County, Missouri

How To Use This Soil Survey

General Soil Map

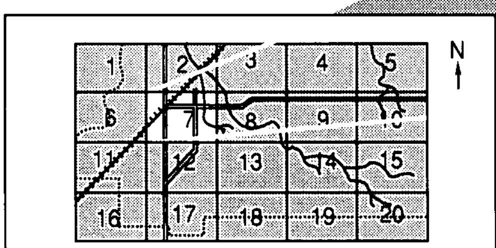
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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

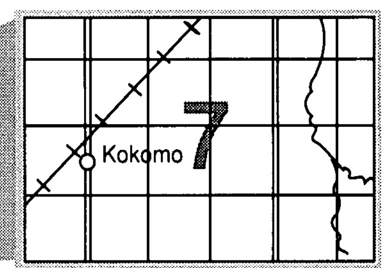
Detailed Soil Maps

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

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

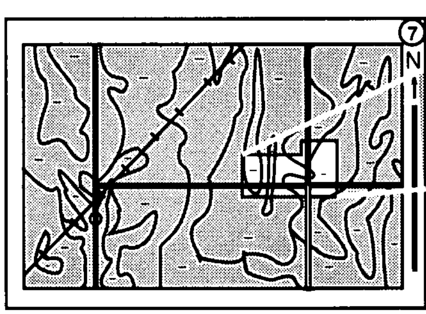


INDEX TO MAP SHEETS



MAP SHEET

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



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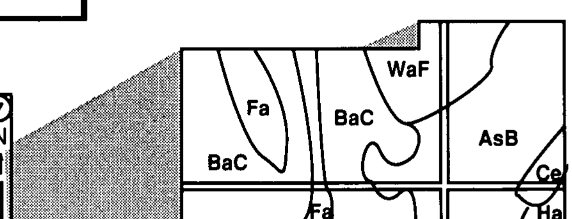

AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1988. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1988. This survey was made cooperatively by the Soil Conservation Service and the Missouri Agricultural Experiment Station. The Missouri Department of Natural Resources provided a soil scientist to assist with the fieldwork. The Saline County Soil and Water Conservation District, through donations from the Saline County Commission and individual landowners, provided funds for a soil scientist to assist with the fieldwork. This survey is part of the technical assistance furnished to the Saline County Soil and Water Conservation District.

Cover: Typical area of the Sibley-Higginsville association in Saline County.

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Foreword

This soil survey contains information that can be used in land-planning programs in the survey area. 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 over bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to 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.

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Soil Survey of Saline County, Missouri

By John L. Baker, Soil Conservation Service

Fieldwork by John L. Baker, Soil Conservation Service; Jim Vaughn, Kim Todd, and Richard L. Henderson, State Department of Natural Resources; and Steve Niebregge and Greg Caldwell, Saline County Soil and Water Conservation District

United States Department of Agriculture, Soil Conservation Service, in cooperation with Missouri Agricultural Experiment Station

SALINE COUNTY is in the central part of Missouri (fig. 1). It is bordered by the Missouri River on the north. It has a total area of 490,938 acres, or about 767 square miles. Marshall, the county seat, is in the central part of the county. In 1980, the population of Marshall was 12,781 and that of the county was 24,919 *(18)*.

Saline County is mostly in the Iowa and Missouri Deep Loess Hills major land resource area of the Central Feed Grains and Livestock Region. The southeastern part of the county, however, is in the Central Mississippi Valley Wooded Slopes major land resource area in the same region and in the Ozark Highland major land resource area of the East and Central General Farming and Forest Region *(3)*.

This survey area includes small parts of Carroll and Chariton Counties that are on the same side of the Missouri River as Saline County. The Saline County Soil and Water Conservation District serves these parts of Carroll and Chariton Counties.

Farming is the main enterprise in the survey area. Soybeans, corn, and winter wheat are the major crops, and beef cattle and hogs are the principal kinds of livestock. The flood plains along the Missouri River and the less sloping areas on uplands are used for cultivated crops. The steeper areas are used mostly for pasture, hay, woodland, or orchards.

Commerce and industry are growing sources of income in the survey area. Some of the industries are meat packing, food processing, and feed and seed enterprises. Interstate 70, U.S. Highway 65, the Missouri River, and the railway system are means of transporting industrial and other goods in the survey area.

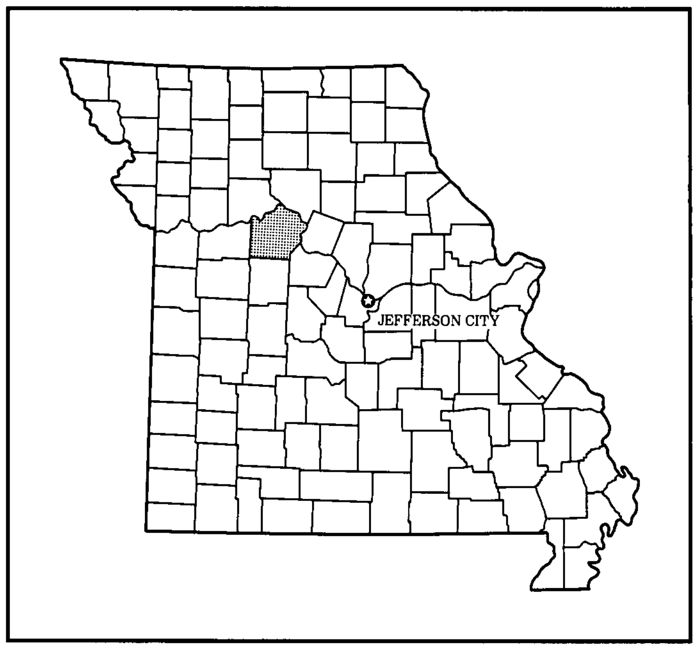

Figure 1.—Location of Saline County in Missouri.

This soil survey updates the survey of Saline County published in 1905 *(12)*. It provides additional interpretive information and has larger maps, which show the soils in greater detail.

General Nature of the Survey Area

This section gives general information about the survey area. It describes history; climate; physiography, relief, and drainage; and water supply.

History

The survey area was part of the Louisiana Purchase of 1803. The first settlements were in the eastern part of the survey area, where Arrow Rock stands today and on the Missouri River bottom north of Arrow Rock. These settlements were established between 1807 and 1810 *(11)*.

The early settlers, who were from Kentucky, Tennessee, Virginia, and Indiana, settled in timbered areas and on the river bottoms close to areas of fresh water. They hunted and fished, and they cleared small patches of woodland, which they planted to corn and vegetables for their own consumption. Initially, they believed that the prairie soils could not produce the yields of the soils in the areas of woodland and on river bottoms. During the growing season of 1819, however, two settlers tried planting 3 pecks of wheat in the open prairie. Their yields of 20 bushels of wheat convinced them of the fertility of the prairie soils, which made up nearly 90 percent of the survey area. The settlement of the prairie expanded as the population increased *(12)*.

On November 25, 1820, the General Assembly divided Cooper County and established Saline County. The name Saline is derived from the numerous salt springs located within the boundaries of the county. The county originally included Pettis County and part of Benton County. The legislature established the present boundaries of the county in 1825. In 1831, the county seat, which had been established at Jefferson, was moved to Jonesboro, now Napton. In 1839, it was moved again, to a new courthouse in Marshall, where it remains *(12)*.

The first census of the county, taken in 1821, reported a population of 1,176 residents. The population reached 33,703 by 1900. It declined to 24,919 by 1980. All areas within the county recorded a smaller population, except for Marshall Township. In 1920, the county had 2,004 farms, which averaged 140 acres in size. In 1982, it had 1,168 farms, which averaged 341 acres in size *(8)*.

Agriculture has always been the most important sector of the economy in the survey area. More than 300,000 acres in the area is farmed. The production of row crops, namely corn and soybeans, accounts for almost half of the total farm income.

For the last several years, Saline County has ranked first or second in corn production in the state. It produced 13,655,000 bushels in 1985. The acreage used for corn was about 110,100 acres for 100 years until 1979. From 1980 through 1984, it ranged from 83,000 to 92,100 acres. In 1985, it was 111,000 acres. Major improvements in management practices, fertilizer, and seed quality have increased the average yield of corn from 38 bushels per acre in 1920 to 123 bushels per acre in 1985 *(9)*.

Soybean production for seed started in the late 1920's and steadily increased until 1980, when 130,000 acres was used for soybeans for seed. About 114,000 acres was used for soybeans in 1985 *(9)*.

Winter wheat and grain sorghum generally are minor crops in the county. The acreage of these crops fluctuates, depending on market value and weather conditions. In 1985, about 22,900 acres was planted to wheat and 10,700 acres to grain sorghum *(9)*.

Raising beef cattle and hogs has been a major enterprise in the county.

The Saline County Soil and Water Conservation District, the 100th such district in Missouri, was organized in 1973.

Climate

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at Marshall, Missouri, in the period 1951 to 1986. 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 32 degrees F and the average daily minimum temperature is 22 degrees. The lowest temperature on record, which occurred at Marshall on January 17, 1977, is -16 degrees. In summer, the average temperature is 77 degrees and the average daily maximum temperature is 89 degrees. The highest recorded temperature, which occurred on July 14, 1954, is 112 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 36.13 inches. Of this, about 23 inches, or nearly 65 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 18 inches. The heaviest 1-day rainfall during the period of record was 5.87 inches at Marshall on April 21, 1973. Thunderstorms occur on about 53 days each year. Tornadoes and severe thunderstorms occur occasionally, but they are local in extent and of short duration. They cause damage in scattered small areas. Hailstorms occur in scattered small areas at times during the warmer part of the year.

The average seasonal snowfall is about 14 inches. The greatest snow depth at any one time during the period of record was 8 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 50 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 12 miles per hour, in spring.

Physiography, Relief, and Drainage

The survey area consists of several physiographic areas. The northern and eastern parts of the survey area are on the nearly level flood plains along the Missouri River. These flood plains are a few feet to about 6 miles wide at the widest point. Silty and sandy soils generally are close to the river channel, and clayey soils are farther from the channel. Some of the old channels are low and wet and can be farmed only during periods of low rainfall.

The north-central part of the survey area is on a high terrace that is 60 to 70 feet above the flood plains along Missouri River. The terrace consists of 20 to 30 feet of loess over glacial drift. It generally is nearly level to gently sloping, but slopes may be more than 8 percent along the escarpment on the outer edge of the terrace.

The rest of the survey area is on gently sloping to steep, dissected uplands. These uplands are in areas of glacial till and Pennsylvanian and Mississippian bedrock covered by loess of varying thickness. The loess is thickest in the highly dissected hills close to the Missouri River. It gradually thins to the south, where ridgetops are loess covered and have side slopes of limestone, shale, and sandstone *(5)*. Glacial till is exposed along the deeply entrenched drainageways in the northern half of the survey area. Elevation ranges from 590 feet above sea level in an area along the Missouri River in the southeast corner of the county to about 870 feet on the highest ridges in the uplands.

The pattern of drainage in the survey area is generally from northwest to southeast. The northern and eastern parts of the survey area are drained directly by the Missouri River. The main tributaries of the river are the Van Meter ditch and Edmonson, Buck, Bear, Fish, and Pierre Fleche Creeks. The Salt Fork of the Blackwater River and the Blackwater River drain the central and southern parts of the survey area (fig. 2). The main tributaries of the Salt Fork are Straddle, Cow, Camp, and Muddy Creeks, and the main tributaries of the Blackwater River are Davis and Finney Creeks. A small acreage in the southeastern part of the survey area is drained by the Lamine River. All of the surface water in the survey area eventually flows into the Missouri River.

Water Supply

Most of the soils on uplands in the survey area are suitable for the construction of ponds and small reservoirs. These impoundments provide most of the water for livestock.

Saline County acquired its name from the numerous salt springs located in the survey area. The flow from these springs has greatly diminished. The water from the consolidated rock formations that underlie the survey area generally is high in chlorides and sulfates, especially in the southwestern and northeastern parts of the survey area, where Pennsylvanian shales and sandstones are thickest. The shales prevent the recharge of the water in the bedrock *(7)*. In areas having no Pennsylvanian bedrock, water of good quality is available. The yield of this water generally is low for public uses but is adequate for individual farmsteads. The rate of flow and depth to water are unpredictable *(19)*.

Water of sufficient quantity and quality for public uses is available in areas of alluvium along the Missouri and Blackwater Rivers and in areas of glacial drift underlying the north-central part of the survey area. The alluvium and the drift in these areas are reliable sources of good-quality water for future demands. A map showing the location of these areas can be obtained from the Missouri Geological Survey of the State Department of Natural Resources. The city of Slater draws water from wells in the alluvium along the Missouri River, as do several irrigation systems. The city of Marshall and several other small communities draw water from wells in the glacial drift underlying the Malta Bend terrace. These wells produce 550 to 1,000 gallons of water per minute *(19)*.

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

Figure 2.—An area of the Blackwater River. The river and its tributaries drain most of the survey area.

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 biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and 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 a considerable degree of 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, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

The descriptions, names, and delineations of the soils identified on the general soil map of this survey area do not fully agree with those in the surveys of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions. In some areas combining small acreages of similar soils that respond to use and management in much the same way was more practical than separating these soils and giving them different names.

Soil Descriptions

1. Haynie-Waldron-Leta Association

Deep, nearly level, moderately well drained and somewhat poorly drained soils formed in alluvium; on flood plains

This association is on wide flood plains along the Missouri River. Differences among the soils result largely from variations in the texture of the material in which they formed. In general, the loamy soils are in the highest positions on the landscape and the clayey soils are in the lowest positions. Slopes range from 0 to 2 percent.

This association makes up about 11 percent of the survey area. It is about 25 percent Haynie soils, 24 percent Waldron soils, 17 percent Leta soils, and 34 percent soils of minor extent (fig. 3).

Haynie soils are moderately well drained and are in slightly raised positions. Typically, the surface layer is very dark grayish brown silt loam. The substratum is grayish brown and brown silt loam and very fine sandy loam. It is mottled in the lower part.

Waldron soils are somewhat poorly drained and are in the lower areas. Typically, the surface layer is very dark gray silty clay. The substratum is stratified very dark gray and dark grayish brown silty clay in the upper part, stratified dark grayish brown silty clay and grayish brown silt loam in the next part, and stratified dark gray and very dark grayish brown silty clay in the lower part.

Leta soils are somewhat poorly drained and are lower on the flood plains than the Haynie soils and higher than the Waldron soils. Typically, the surface layer and subsurface layer are very dark grayish brown and very dark gray silty clay. The subsoil is dark grayish brown silty clay. The substratum is grayish brown, mottled very fine sandy loam.

Minor in this association are Aholt, Levasy, and Moville soils. Aholt soils are very poorly drained and are in low backwater areas. Levasy soils are poorly drained and are in low areas. Moville soils are silty in the upper part and clayey in the lower part. They are in landscape positions similar to those of the Leta soils.

Grain farming is the main enterprise in areas of this association. The main crops are soybeans, corn, and winter wheat. Wetness, flooding, and a high content of clay are the main management concerns in areas of the Leta and Waldron soils.

A few small areas support trees. These areas are mainly next to the Missouri River channel and are not protected from flooding. These soils are suited to trees. The windthrow hazard and seedling mortality are the

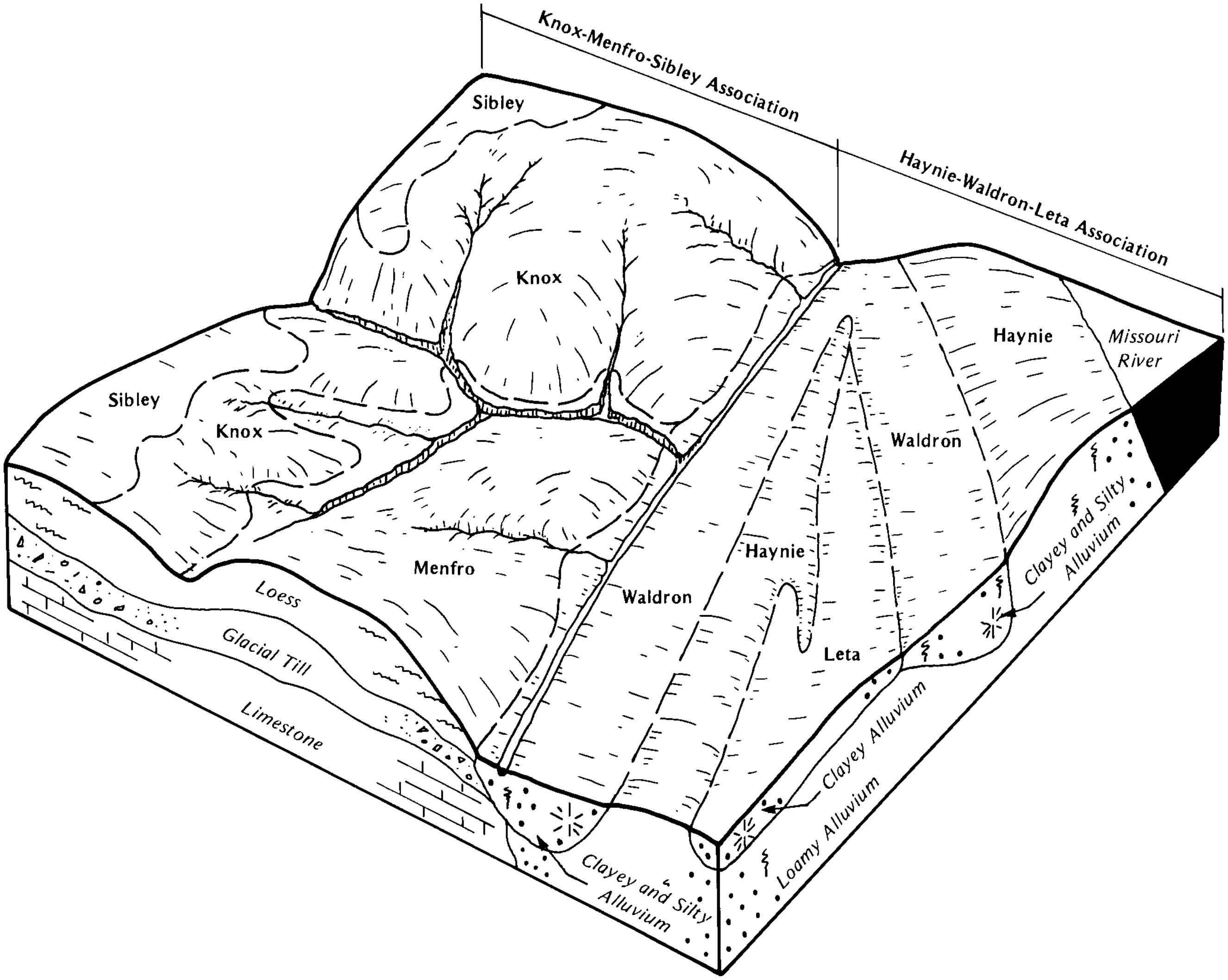

Figure 3.—Typical pattern of soils and parent material in the Haynie-Waldron-Leta and Knox-Menfro-Sibley associations.

main management concerns on the Leta soils. Seedling mortality is the main management concern on the Waldron soils.

The soils in this association are unsuited to building site development and sanitary facilities because of the flooding.

2. Knox-Menfro-Sibley Association

Deep, gently sloping to steep, well drained soils formed in loess; on uplands

This association is on narrow and moderately wide ridgetops and side slopes dissected by many branching, V-shaped drainageways. The side slopes generally are short. Slopes range from 2 to 35 percent.

This association makes up about 11 percent of the survey area. It is about 36 percent Knox and similar soils, 34 percent Menfro soils, 16 percent Sibley soils, and 14 percent soils of minor extent (fig. 3).

The gently sloping to steep Knox soils are on narrow ridgetops and convex side slopes below the Sibley soils. Typically, the surface layer is dark brown silt loam. The subsoil is brown silt loam in the upper part and dark yellowish brown silty clay loam in the lower part. The substratum is dark yellowish brown silt loam.

The gently sloping to steep Menfro soils are on narrow ridgetops and convex side slopes below the Knox soils. Typically, the surface layer is brown silt loam. The subsoil is dark yellowish brown and brown silty clay loam.

The gently sloping to strongly sloping Sibley soils are on the higher wide ridgetops and side slopes. Typically, the surface layer and subsurface layer are very dark grayish brown silt loam. The subsoil is dark brown and dark yellowish brown silty clay loam in the upper part and dark yellowish brown and yellowish brown, mottled silty clay loam and silt loam in the lower part.

Minor in this association are the somewhat poorly drained Higginsville soils and the moderately well drained Weller soils. Higginsville soils are at the head of drainageways. Weller soils are in the lower positions on side slopes below the Menfro soils.

About 70 percent of this association has been cleared and is used as cropland or pasture. Soybeans, winter wheat, and corn are grown in the less sloping areas. Cool-season grasses and legumes are grown for pasture and hay. Measures that help to control erosion are the major management needs if row crops are grown. Overgrazing of pastures during wet periods results in severe erosion in the steep areas.

The steeper areas of the Knox and Menfro soils are forested. Oaks and hickories are the dominant trees. The steep slopes restrict the use of logging roads and skid trails.

This association is suited to building site development and sanitary facilities. The slope and a moderate shrink-swell potential are the major problems.

3. Monona-Joy-Winterset Association

Deep, nearly level to moderately sloping, well drained, somewhat poorly drained, and poorly drained soils formed in loess; on high stream terraces

This association is on the low, broad ridgetops and long, gentle side slopes of high stream terraces adjacent to the flood plains along the Missouri River. Slopes range from 0 to 9 percent.

This association makes up about 3 percent of the survey area. It is about 41 percent Monona soils, 35 percent Joy soils, 14 percent Winterset soils, and 10 percent soils of minor extent (fig. 4).

The gently sloping and moderately sloping Monona soils are well drained and are on low ridges and convex side slopes. Typically, the surface layer is very dark brown silt loam. The subsurface layer is very dark grayish brown silt loam. The subsoil is silt loam. It is very dark grayish brown in the upper part and dark yellowish brown in the lower part.

The nearly level Joy soils are somewhat poorly drained and are in broad areas adjacent to the Monona soils. Typically, the surface layer is black silt loam. The subsurface layer is very dark grayish brown silt loam. The subsoil is grayish brown and yellowish brown silt loam. The substratum is gray silt loam.

The nearly level Winterset soils are poorly drained and are in depressions adjacent to the Joy soils. Typically, the surface layer is black silt loam. The subsurface layer also is black silt loam. The subsoil is mottled silty clay loam. It is very dark gray and dark gray in the upper part and grayish brown in the lower part.

Minor in this association are Leslie and Colo soils. Leslie soils have a leached, light gray subsurface layer. They are in depressions below the Joy soils. Colo soils are nearly level and are on narrow flood plains. They have more clay in the subsoil than the Monona soils.

Grain farming is the main enterprise in areas of this association. The main crops are corn, soybeans, and winter wheat. Controlling erosion and draining wet spots are the main management concerns.

The Monona and Joy soils are suited to building site development and sanitary facilities. Wetness in the Joy soils and the shrink-swell potential in the Monona soils are the main problems. The Winterset soils generally are not suited to building site development and sanitary facilities because of wetness.

4. Dockery-Colo Association

Deep, nearly level, somewhat poorly drained and poorly drained soils formed in alluvium; on flood plains

This association is on flood plains along the Blackwater River and its tributaries. The flood plains are intermediate in size or are narrow. Slopes range from 0 to 2 percent.

This association makes up about 5 percent of the survey area. It is about 45 percent Dockery soils, 24 percent Colo soils, and 31 percent soils of minor extent (fig. 4).

Dockery soils are somewhat poorly drained and are near the stream channels. Typically, the surface layer is very dark grayish brown silt loam. The substratum is stratified dark grayish brown, grayish brown, and very dark gray silt loam.

Colo soils are poorly drained and are in the lower areas. Typically, the surface layer is black silty clay loam. The subsurface layer is very dark gray silty clay loam. The subsoil is black silty clay loam.

Minor in this association are Bremer, Moniteau, and Vesser soils on the higher flood plains. Bremer soils have more clay in the subsoil than the Dockery and Colo soils. Moniteau and Vesser soils have a leached subsurface layer.

Grain farming is the main enterprise in areas of this association. The main crops are soybeans, corn, and winter wheat. Flooding and wetness are the major management concerns.

This association is suited to cool-season grasses and legumes that can withstand wetness. The wetness and the flooding are the main management concerns.

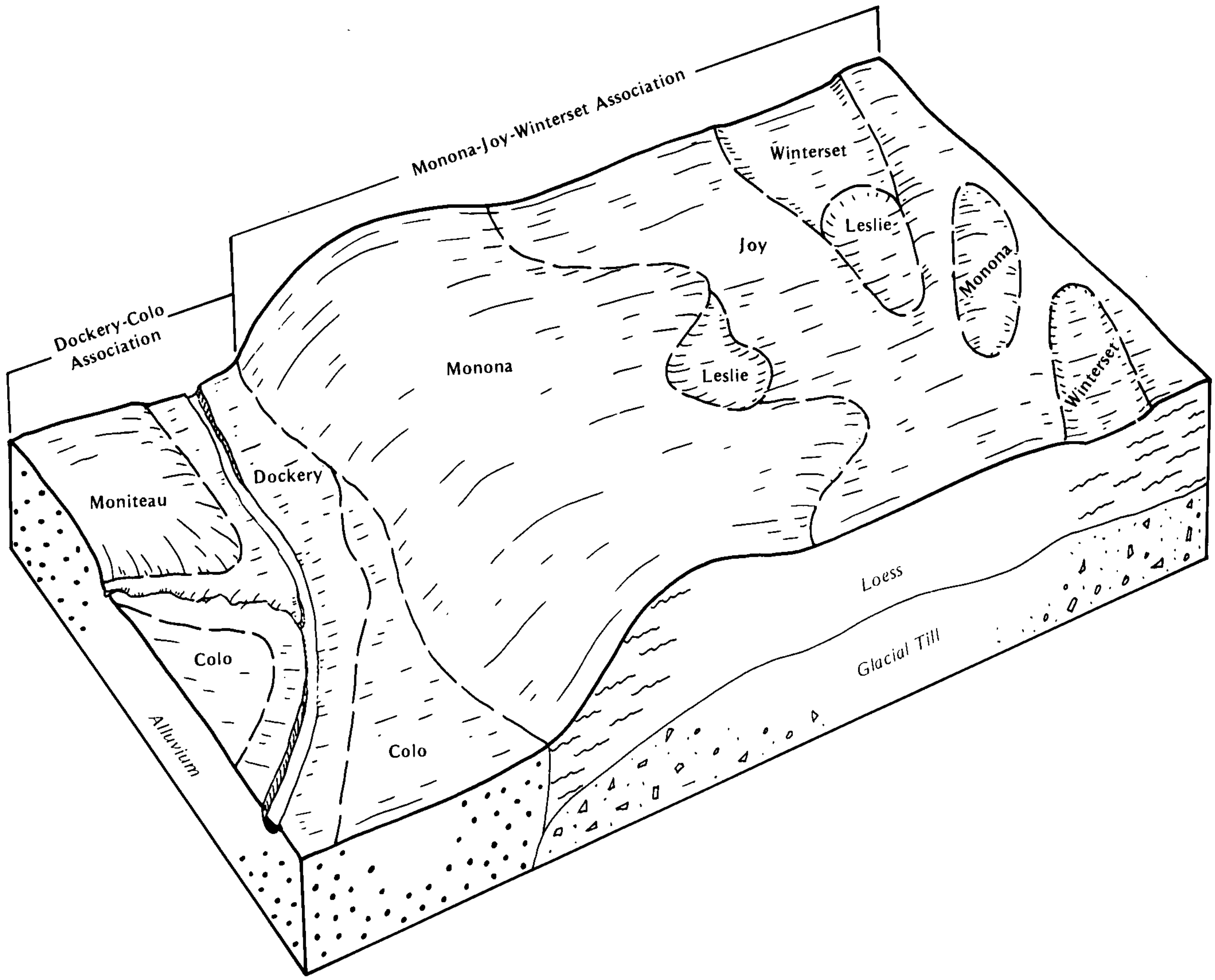

Figure 4.—Typical pattern of soils and parent material in the Monona-Joy-Winterset and Dockery-Colo associations.

This association is not suited to building site development or sanitary facilities because of the wetness and the flooding.

5. Macksburg-Arispe Association

Deep, very gently sloping to strongly sloping, somewhat poorly drained soils formed in loess; on uplands

This association is on ridgetops and side slopes on high, broad divides between the major drainageways. Slopes range from 1 to 14 percent.

This association makes up about 32 percent of the survey area. It is about 36 percent Macksburg and similar soils, 35 percent Arispe soils, and 29 percent soils of minor extent (fig. 5).

The very gently sloping Macksburg soils are on broad ridgetops. Typically, the surface layer is black silt loam. The subsurface layer is very dark gray silt loam. The subsoil is silty clay loam. It is very dark grayish brown in the upper part, dark grayish brown and mottled in the next part, and mottled grayish brown and yellowish brown in the lower part.

The gently sloping to strongly sloping Arispe soils are on concave side slopes. Typically, the surface layer is black silt loam. The subsoil is very dark gray silty clay loam in the upper part; dark grayish brown, mottled silty clay in the next part; and grayish brown, mottled silty clay loam in the lower part. The substratum is light brownish gray, mottled silty clay loam.

Minor in this association are Dockery, Leslie, and

Weller soils. Dockery soils are nearly level and are on flood plains along small streams. Leslie soils have a leached subsurface layer. They are on side slopes or high stream terraces below the Arispe soils. Weller soils have a light colored surface layer. They are on slightly concave side slopes in the more dissected areas of the association.

Grain farming is the main enterprise in areas of this association. The main crops are soybeans, corn, and winter wheat. Grasses and legumes that can withstand wetness are grown on a small acreage. If row crops are grown, measures that help to control erosion and reduce the wetness are the major management needs.

If this association is used for building site development or onsite waste disposal, the wetness, slow permeability, and a high shrink-swell potential are the major limitations.

6. Sibley-Higginsville Association

Deep, gently sloping to strongly sloping, well drained and somewhat poorly drained soils formed in loess; on uplands

This association is on narrow ridgetops and smooth, short, concave side slopes. Slopes range from 2 to 14 percent.

This association makes up about 23 percent of the survey area. It is about 56 percent Sibley and similar soils, 36 percent Higginsville and similar soils, and 8 percent soils of minor extent (fig. 6).

The gently sloping to strongly sloping Sibley soils are well drained and are on narrow ridgetops, convex side slopes, and the ends of ridges. Typically, the surface layer and subsurface layer are very dark grayish brown silt loam. The subsoil is dark brown and dark yellowish silty clay loam in the upper part and dark yellowish brown and yellowish brown, mottled silty clay loam and silt loam in the lower part.

The gently sloping and moderately sloping Higginsville soils are somewhat poorly drained and are on slightly concave side slopes and at the head of drainageways. Typically, the surface layer and subsurface layer are black silt loam. The subsoil is silty clay loam. The upper part is very dark grayish brown, and the lower part is dark grayish brown and grayish brown and is mottled. The substratum is light brownish gray, mottled silty clay loam.

Minor in this association are Ackmore, Colo, and

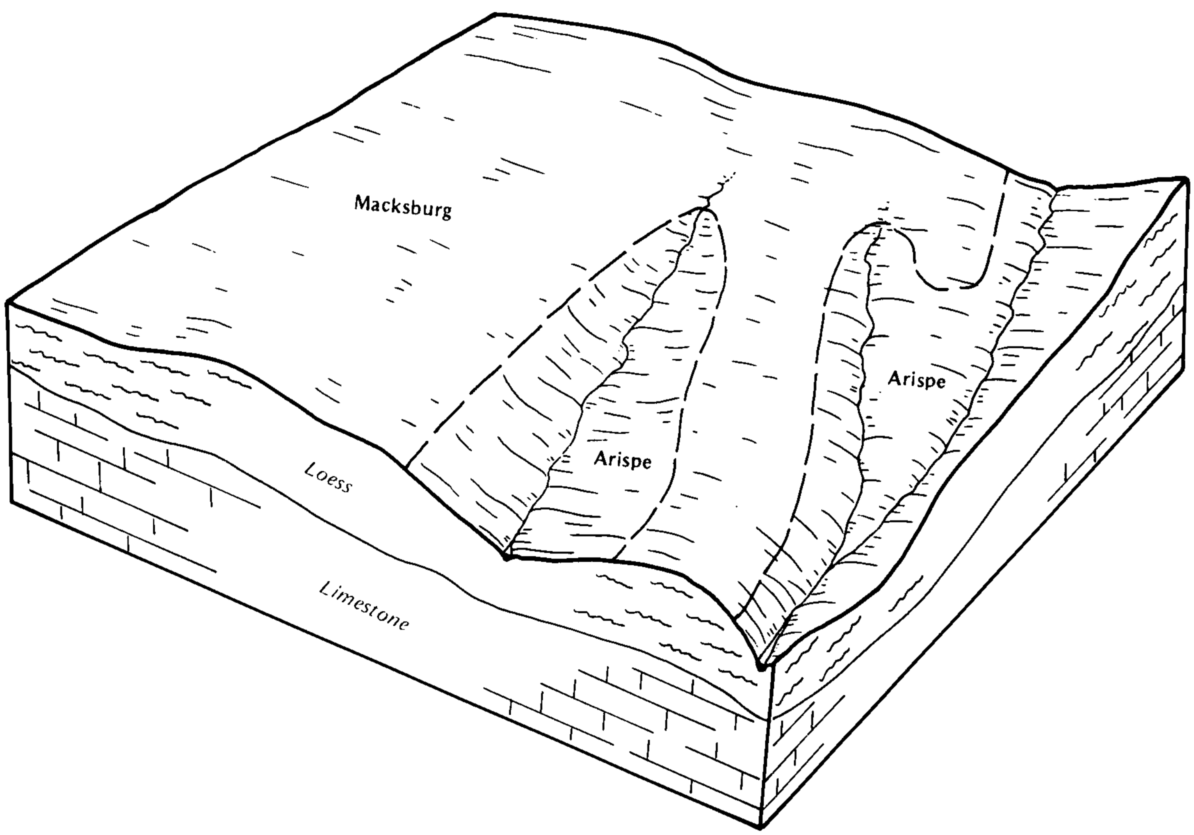

Figure 5.—Typical pattern of soils and parent material in the Macksburg-Arispe association.

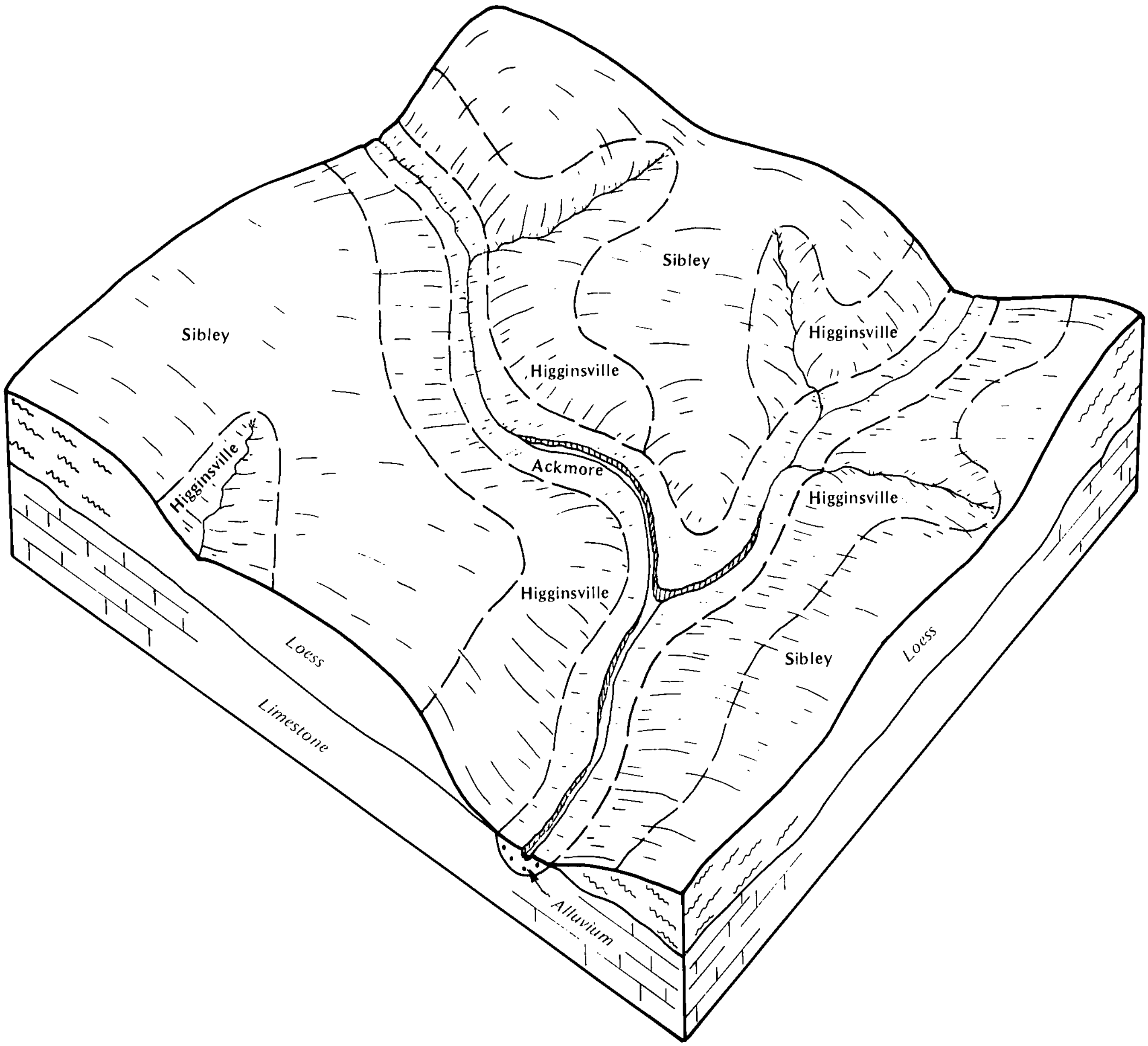

Figure 6.—Typical pattern of soils and parent material in the Sibley-Higginsville association.

Greenton soils. Ackmore soils have a buried soil at a depth of 18 to 36 inches. They are on flood plains along small streams. Colo soils are poorly drained and are on flood plains. Greenton soils have more clay in the subsoil than the Higginsville soils. They are in landscape positions similar to those of the Higginsville soils.

Grain and livestock farming are the main enterprises in areas of this association. The major crops are corn, soybeans, and winter wheat. Cool-season grasses and legumes are grown for pasture and hay. Controlling erosion and draining seepy areas are the major management concerns if row crops are grown.

This association is suited to building site development and sanitary facilities. The slope, a moderate shrink-swell potential, and wetness are the main problems.

7. Weller-Winfield-Goss Association

Deep, gently sloping to steep, moderately well drained and well drained soils formed in loess or cherty limestone residuum; on uplands

This association is in highly dissected areas adjacent to the Blackwater River and its tributaries. Ridgetops are long and narrow, and drainageways are deep and V-shaped and have narrow flood plains. Slopes range from 2 to 45 percent.

This association makes up about 15 percent of the survey area. It is about 46 percent Weller soils, 20 percent Winfield soils, 16 percent Goss and similar soils, and 18 percent soils of minor extent (fig. 7).

The gently sloping to strongly sloping Weller soils are moderately well drained and are on the lower ridgetops and side slopes. Typically, the surface layer is brown silt loam. The upper part of the subsoil is yellowish brown, mottled silty clay loam. The next part is yellowish brown and grayish brown, mottled silty clay. The lower part is light brownish gray, mottled silty clay loam. The substratum also is light brownish gray, mottled silty clay loam.

The gently sloping and moderately sloping Winfield soils are well drained and are on the higher ridgetops and side slopes. Typically, the surface layer is brown silt loam. The subsoil is yellowish brown silty clay loam. It is mottled in the lower part. The substratum is yellowish brown, mottled silt loam.

The moderately steep and steep Goss soils are well drained and are on the lower convex side slopes. Typically, the surface layer is dark brown cherty silt loam. The subsurface layer is yellowish brown very cherty silt loam. The subsoil is yellowish red very cherty silty clay in the upper part and red very cherty clay in the lower part.

Minor in this association are the nearly level and very gently sloping Dameron and nearly level Dockery soils on narrow flood plains.

This association is used mainly as pasture and woodland. Some of the gently sloping and moderately sloping areas are used for row crops.

This association is suited to pasture. Most of the commonly grown legumes and cool-season grasses grow well or moderately well. Measures that control erosion are the main management needs during and after establishment of the pasture. Droughtiness and chert fragments on the surface are management concerns on the cherty soils.

This association is well suited to trees. Many of the

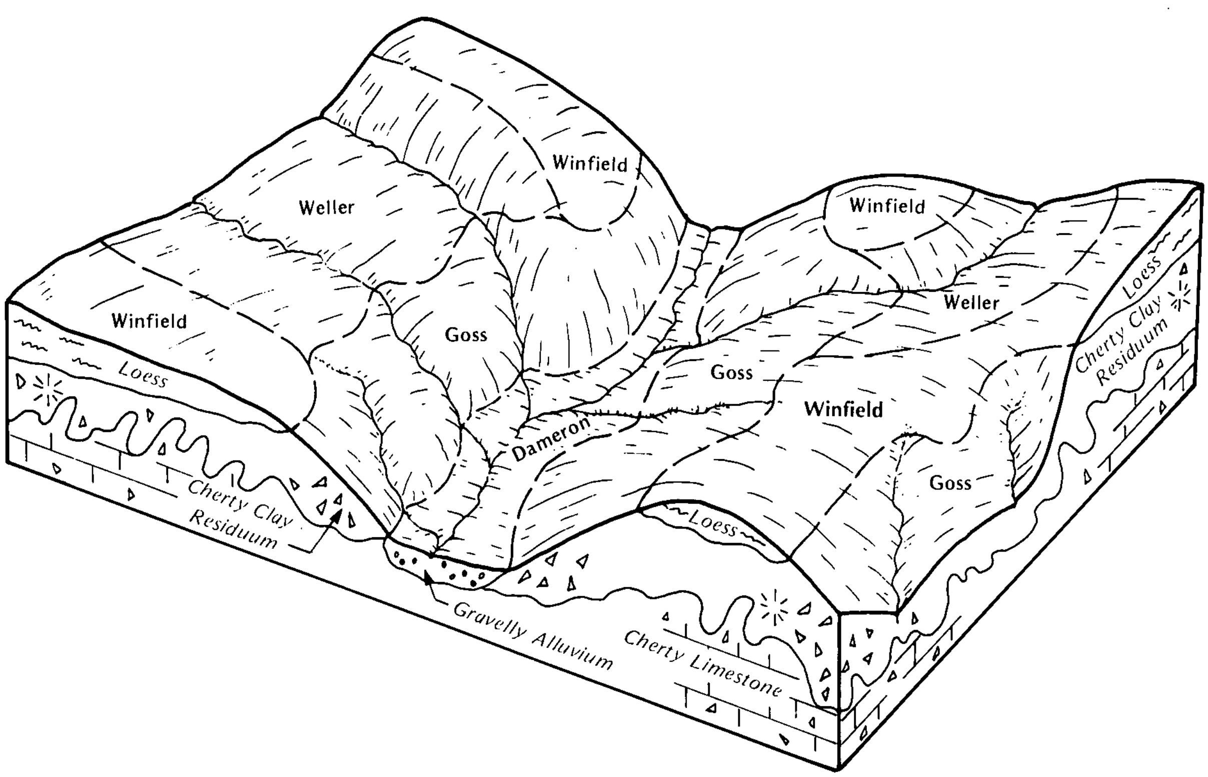

Figure 7.—Typical pattern of soils and parent material in the Weller-Winfield-Goss association.

moderately steep and steep areas are used as hardwood forest. The slope hinders the use of harvesting and planting equipment. Seedling mortality is a management concern.

The gently sloping and moderately sloping soils in this association are suited to cultivated crops. Erosion and wetness are the main management concerns.

The soils in this association are suited to habitat for woodland wildlife. Planting food plots and protecting the habitat from grazing and fire increase the amount of food and cover for wildlife.

The gently sloping to strongly sloping soils in this association are suited to building site development and onsite waste disposal. Wetness, the shrink-swell potential, and the slope are the main limitations. The steeper soils generally are not suited to building site development or onsite waste disposal.

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 help 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, 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, Sibley silt loam, 2 to 5 percent slopes, is a phase of the Sibley 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. Haynie-Waldron complex 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, 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.

The descriptions, names, and delineations of the soils identified on the detailed soil maps of this survey area do not fully agree with those in the surveys of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions. In some areas combining small acreages of similar soils that respond to use and management in much the same way was more practical than separating these soils and giving them different names.

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

03—Aholt clay. This deep, nearly level, very poorly drained soil is in slightly depressional areas on flood plains along the Missouri River. The soil is protected by levees but still is occasionally flooded by local tributaries or because of levee breaks (fig. 8). Individual areas are long and narrow and range from 10 to more than 100 acres in size.

Typically, the surface layer is very dark gray, very firm clay about 8 inches thick. The subsurface layer is very dark gray, mottled, very firm clay about 9 inches thick. The subsoil extends to a depth of 60 inches or more. It is dark gray, mottled, very firm clay in the

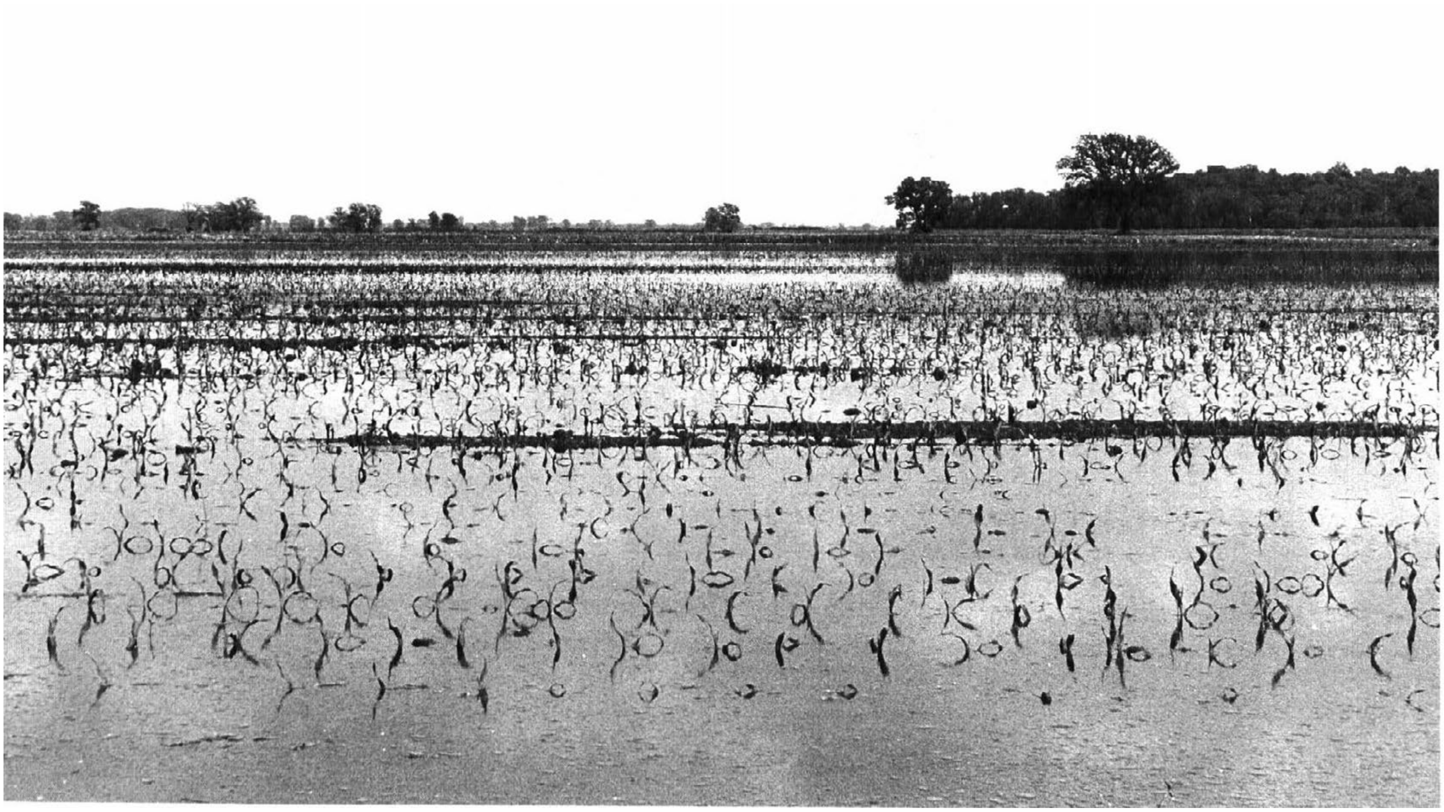

Figure 8.—Flooding in a cultivated area of Aholt clay.

upper part and mottled dark gray and gray, very firm silty clay in the lower part. In a few places the very dark gray surface layer is less than 10 inches thick. In a few areas the surface layer is silty clay.

Included with this soil in mapping are a few areas of the moderately well drained Haynie soils, the somewhat poorly drained Leta soils, and the poorly drained Levasy soils. Haynie soils are silty and loamy throughout. They are in the higher landscape positions. Leta and Levasy soils are clayey in the upper 20 to 38 inches and loamy in the lower part. Leta soils are at the slightly higher elevations, and Levasy soils are in some of the depressional areas. Also included are some areas of Aholt soils that are subject to ponding. Included soils make up less than 5 percent of the unit.

Permeability is very slow in the Aholt soil. Surface runoff also is very slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity also is moderate. The seasonal high water table commonly is within a depth of 1 foot during most winter and spring months. The shrink-swell potential is very high. The clayey surface layer can be tilled only within a very narrow range in moisture content. It puddles and crusts after hard rains.

Nearly all areas are used for cultivated crops. This soil generally is not used for pasture or hay. It is suited to soybeans, corn, winter wheat, and grain sorghum. The wetness is the main limitation. It can be reduced by land grading, shallow surface drains, and open ditches. Delayed planting may be necessary to minimize the damage caused by flooding. 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. Plowing in the fall improves tilth for the crops grown the following spring.

This soil is suited to trees. The equipment limitation, seedling mortality, and windthrow are the main management concerns. Equipment should be used only when the soil is dry or frozen. Ridging the soil and then planting on the ridges increase the seedling survival rate. Light, frequent thinning reduces the hazard of windthrow.

This soil is well suited to wetland wildlife habitat. The wetland plants that provide food and cover for wildlife grow well. They can be naturally established in 3 to 5 years, or they can be planted by seed or rootstock. Shallow impoundments can be constructed by damming drainageways or by building berms around the intended area. Good wetland habitat consists of about 50 percent open water and 50 percent emergent vegetation. It can be attained by mowing when the area is dry or by keeping water 3.5 feet deep in half of the area and maintaining a cover of shallow water in the other half. The water depth can be adjusted by digging pits in the wetland area or by installing an outlet in the berm or dam. Opening or closing the outlet can regulate the water depth in the impoundment *(6)*.

This soil is unsuitable for building site development and onsite waste disposal because of the wetness and the flooding.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

04—Booker clay. This deep, nearly level, very poorly drained soil is in slightly depressional areas on flood plains along the Missouri River. The soil is protected by levees but still is occasionally flooded by local tributaries or because of levee breaks. It is subject to ponding after heavy rains. Individual areas are long and narrow and range from 10 to more than 100 acres in size.

Typically, the surface soil is very dark gray, firm clay about 16 inches thick. The subsoil to a depth of 60 inches or more is dark gray and gray, mottled, very firm clay. In some areas free carbonates are throughout the soil.

Included with this soil in mapping are small areas of the poorly drained Levasy soils. These soils have a substratum of very fine sandy loam at a depth of 20 to 38 inches. They make up about 5 percent of the unit.

Permeability is very slow in the Booker soil, and surface runoff is very slow or ponded. Natural fertility is high, and the content of organic matter is moderate. The available water capacity also is moderate. The seasonal high water table commonly is 0.5 foot above to 1.0 foot below the surface during most winter and spring months. The shrink-swell potential is very high. The clayey surface layer can be tilled only within a very narrow range in moisture content. It puddles and crusts after hard rains. Root development is restricted by poor aeration.

Nearly all areas are used for cultivated crops. This soil is suited to soybeans, corn, winter wheat, and grain sorghum. The wetness is the main limitation. Measures that intercept runoff from the adjacent hillsides, land grading, shallow surface drains, and open ditches help to remove excess water. A conservation tillage system that leaves crop residue on the surface helps to prevent surface crusting, improves fertility, and increases the rate of water infiltration. Plowing in the fall improves tilth for the crops grown the following spring.

This soil is suited to trees. The equipment limitation, seedling mortality, and windthrow are the main management concerns. Equipment should be used only when the soil is dry or frozen. Ridging the soil and then planting on the ridges increase the seedling survival rate. Light, frequent thinning reduces the hazard of windthrow.

This soil is well suited to habitat for wetland wildlife. The wetland plants that provide food and cover for wildlife grow well. They can be naturally established in 3 to 5 years, or they can be planted by seed or rootstock. Shallow impoundments can be constructed by damming drainageways or by building berms around the intended area. Good wetland habitat consists of about 50 percent open water and 50 percent emergent vegetation. It can be attained by mowing when the area is dry or by keeping water 3.5 feet deep in half of the area and maintaining a cover of shallow water in the other half. The water depth can be adjusted by digging pits in the wetland area or by installing an outlet in the berm or dam. Opening or closing the outlet can regulate the water depth in the impoundment *(6)*.

This soil is unsuitable for building site development and onsite waste disposal because of the flooding and the wetness.

The land capability classification is IIIw. The woodland ordination symbol is 6W.

05D2—Bluelick silt loam, 9 to 14 percent slopes, eroded. This deep, strongly sloping, well drained soil is on side slopes in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to about 40 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The next layer is brown, friable silty clay loam about 3 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is brown and strong brown, firm silty clay loam and silty clay. The lower part is yellowish red and red, firm very cherty clay. In some areas the soil has chert fragments throughout.

Included with this soil in mapping are small areas of the moderately well drained Winfield soils. These soils are higher on the landscape than Bluelick soil. They make up about 5 percent of the unit.

Permeability is moderately slow in the Bluelick soil. Surface runoff is medium. Natural fertility also is medium, and the content of organic matter is moderately low. The available water capacity is moderate. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled. It tends to crust and puddle, however, after hard rains.

Most areas are used as pasture or woodland. This soil is suited to most of the commonly grown legumes, such as ladino clover and red clover; cool-season grasses, such as tall fescue and timothy; and warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management problems. Seedbeds should be prepared on the contour. Timely seedbed preparation helps to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

Stands of native hardwoods are in some areas. This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suited to the development of habitat for woodland wildlife. The amount of cover for wildlife is adequate. Timely planting of food plots can improve the habitat. The edge of a wooded tract or another fringe area is a good site for food plots. The habitat should be protected from grazing and fire.

This soil is suitable for building site development and onsite waste disposal. The shrink-swell potential and the slope are moderate limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the foundations helps to remove excess water. Some land grading generally is necessary to modify the slope. If the distribution lines are installed across the slope, septic tank absorption fields can function adequately.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IVe. The woodland ordination symbol is 3A.

05E—Bluelick silt loam, 14 to 20 percent slopes. This deep, moderately steep, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 5 to about 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is brown, friable silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is dark brown, firm silty clay loam and yellowish red, firm silty clay. The lower part is yellowish red, very firm extremely cherty silty clay and red, very firm very cherty clay. In some areas the cherty subsoil is at a depth of less than 20 or more than 40 inches.

Included with this soil in mapping are small areas of the moderately well drained Winfield soils. These soils are in the less sloping areas. They make up about 5 percent of the unit.

Permeability is moderately slow in the Bluelick soil. Surface runoff is rapid. Natural fertility is medium, and the content of organic matter is moderately low. The available water capacity is moderate. The shrink-swell potential is moderate in the subsoil.

Most areas are used as woodland. Stands of native hardwoods are in several areas. A few areas are used as pasture.

This soil is well suited to trees. The hazard of erosion and the equipment limitation are the main management concerns. Building logging roads and skid trails on the contour minimizes the safety hazard in operating equipment and helps to control runoff and erosion. Constructing water breaks and seeding disturbed areas after the trees are harvested minimize erosion.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; cool-season grasses, such as tall fescue and timothy; and warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management problems. Seedbeds should be prepared on the contour. Timely seedbed preparation helps to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

This soil is suited to the development of habitat for woodland wildlife. The amount of cover for wildlife is adequate, but forage for wildlife, especially small seed grain, is scarce. Timely planting of food plots can improve the habitat. The edge of a wooded tract or another fringe area is a good site for food plots. The habitat should be protected from grazing and fire.

This soil generally is not used for building site development or onsite waste disposal because of the slope.

The land capability classification is VIe. The woodland ordination symbol is 3R.

07D2—Newcomer silt loam, 9 to 14 percent slopes, eroded. This moderately deep, strongly sloping, well drained soil is on side slopes in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 10 to 40 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil is about 20 inches thick. The upper part is dark yellowish brown, friable silt loam. The lower part is strong brown, friable loam. Below this to a depth of 60 inches or more is soft, weathered sandstone bedrock.

Included with this soil in mapping are small areas of the deep Higginsville and Sibley soils. These soils have less sand in the subsoil than the Newcomer soil. Also, Higginsville soils are lower on the landscape, and Sibley soils are higher. Included soils make up about 15 percent of the unit.

Permeability is moderate in the Newcomer soil. Surface runoff is medium. Natural fertility also is medium, and the content of organic matter is moderate. The available water capacity is low. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used as pasture. Some areas are cultivated along with the surrounding soils. A few areas are wooded.

This soil is suited to pasture and hay. A cover of grasses and legumes is effective in controlling erosion. The soil is well suited to legumes, such as lespedeza and birdsfoot trefoil; cool-season grasses, such as tall fescue and reed canarygrass; and warm-season grasses, such as big bluestem, Caucasian bluestem, and indiangrass. It is moderately suited to most legumes and cool-season grasses. Shallow-rooted species that can tolerate droughtiness should be selected for planting. Erosion control is a serious concern during seeding. Timely tillage and a quickly established ground cover minimize erosion.

A few areas support native hardwoods. This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development and onsite waste disposal. The shrink-swell potential and the slope are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Some land grading may be needed to modify the slope. Septic tank absorption fields can function adequately if installed on a mound of suitable soil material. Mounding increases the depth to bedrock. Alternative soils that are better suited to onsite waste disposal generally can be selected.

Low strength, the shrink-swell potential, and the slope limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling. The roads and streets should be designed so that they conform to the natural slope of the land. Some cutting and filling may be necessary.

The land capability classification is VIe. The woodland ordination symbol is 3A.

07F—Newcomer silt loam, 14 to 35 percent slopes. This moderately deep, moderately steep and steep, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 50 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsurface layer is brown, friable silt loam about 4 inches thick. The subsoil is about 15 inches thick. The upper part is dark yellowish brown, friable silt loam. The lower part is dark yellowish brown, friable loam. The substratum also is dark yellowish brown, friable loam. It is about 6 inches thick. Below this to a depth of 60 inches or more is soft, weathered sandstone bedrock.

Included with this soil in mapping are small areas of the deep, moderately well drained Weller soils. These soils have less sand in the subsoil than the Newcomer soil. They are at the head of drainageways on the higher parts of the landscape. They make up about 5 percent of the unit.

Permeability is moderate in the Newcomer soil. Surface runoff is rapid. Natural fertility is medium, and the content of organic matter is moderate. The available water capacity is low. The shrink-swell potential is moderate in the subsoil.

Most areas are used as woodland. A few small areas are used as pasture. This soil generally is unsuitable for cultivated crops because of the slope and the hazard of erosion.

This soil is suited to trees. The hazard of erosion, the equipment limitation, and seedling mortality are the main management concerns. Building logging roads and skid trails on the contour minimizes the steepness and length of slopes and the concentration of surface water. Constructing water breaks and seeding disturbed areas after the trees are harvested help to control erosion. Operating equipment on the steep slopes can be hazardous. In the steepest areas the logs should be yarded uphill to logging roads or skid trails. In places hand planting or direct seeding is needed. Planting container-grown nursery stock or reinforcement planting increases the seedling survival rate.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to legumes, such as lespedeza and birdsfoot trefoil; cool-season grasses, such as tall fescue and reed canarygrass; and warm-season grasses, such as big bluestem, Caucasian bluestem, and indiangrass. It is moderately suited to most legumes and cool-season grasses. Shallow-rooted species that can withstand droughtiness grow well. Erosion control is needed during seeding. Timely tillage and a quickly established ground cover minimize erosion.

This soil is suited to the development of habitat for woodland wildlife. The amount of cover for wildlife is adequate, but forage for wildlife, especially small seed grain, is scarce. Timely planting of food plots can improve the habitat. The edge of a wooded tract or another fringe area is a good site for food plots. Also, the food plots can be established on the better suited adjacent soils. The habitat should be protected from grazing and fire.

This soil generally is not used for building site development or onsite waste disposal because of the slope.

The land capability classification is VIe. The woodland ordination symbol is 3R.

09—Bremer silt loam. This deep, nearly level, poorly drained soil is on high flood plains along the smaller streams. It is occasionally flooded. Individual areas are generally long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is black, very friable silt loam about 9 inches thick. The subsurface layer is black, friable silt loam about 13 inches thick. The subsoil is mottled, firm silty clay loam about 27 inches thick. It is very dark gray in the upper part and dark grayish brown and grayish brown in the lower part. The substratum to a depth of 60 inches or more is light brownish gray, mottled, firm silty clay loam. In some areas the surface layer is overwash of very dark grayish brown silt loam. In other areas it is silty clay loam.

Included with this soil in mapping are small areas of Ackmore, Colo, and Wiota soils. Ackmore soils have a buried soil at a depth of 18 to 36 inches. They are on flood plains along small streams. Colo and Wiota soils have less clay in the subsoil than the Bremer soil. Colo soils are on flood plains along small streams between areas of the Ackmore and Bremer soils. Wiota soils are well drained and are in the higher convex areas. Included soils make up about 2 to 5 percent of the unit.

Permeability is moderately slow in the Bremer soil. Surface runoff is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is high. The seasonal high water table commonly is at a depth of 1 to 2 feet in most winter and spring months. The shrink-swell potential is high in the subsoil and substratum. The surface layer is friable, but it becomes cloddy if tilled when the soil is wet. Also, it crusts or puddles after hard rains.

Most areas are used for cultivated crops. A few areas are used as pasture. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. The wetness is the main limitation. If cultivated crops are grown, a drainage system is needed in depressions. The flooding can delay tillage in spring. Areas that are plowed in the fall may be subject to scouring by floodwater. Land grading, shallow surface drains, and open ditches help to remove excess water. Diversion terraces may be needed to intercept runoff from the uplands. 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.

This soil is suited to pasture. It is best suited to shallow-rooted legumes that can withstand wetness, such as alsike clover and ladino clover, and to cool-season grasses, such as reed canarygrass. It is poorly suited to warm-season grasses and to hay. The wetness and the flooding are the main management concerns. The hazard of flooding should be considered when grazing systems are designed. Maintaining stands of desirable species is difficult in depressions. A surface drainage system is beneficial, especially if deep-rooted species are grown.

This soil is suited to the trees that can withstand wetness. The equipment limitation, seedling mortality, and windthrow are the main management concerns. Equipment should be used only when the soil is dry or frozen. Ridging the soil and then planting on the ridges increase the seedling survival rate. Light, frequent thinning reduces the hazard of windthrow.

This soil is unsuited to building site development and onsite waste disposal because of the flooding and the wetness.

The land capability classification is IIw. The woodland ordination symbol is 7W.

10A—Dameron silt loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on flood plains along small streams. It is occasionally flooded for very brief periods. Individual areas are long and narrow and range from 5 to 50 acres in size.

Typically, the surface layer is very dark gray, very friable silt loam about 8 inches thick. The subsurface layer is very dark gray and black, friable silt loam about 24 inches thick. The substratum to a depth of 60 inches or more is very dark grayish brown, firm very cherty silty clay loam. In places the surface layer is cherty.

Included with this soil in mapping are small areas of the somewhat poorly drained Dockery soils and the moderately well drained Winfield soils. Dockery soils are stratified silt loam throughout. They are in landscape positions similar to those of the Dameron soil. Winfield soils are on high stream terraces above the Dameron soil. They are chert-free soils in which the content of clay increases by 20 percent between the surface layer and the subsoil. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Dameron soil. Surface runoff is slow. Natural fertility is medium, and the content of organic matter is moderate. The available water capacity also is moderate. The surface layer is very friable and can be easily tilled throughout a moderately wide range in moisture content. It tends to crust or puddle, however, after hard rains.

Most areas are used as pasture, hayland, or woodland. A few areas are used for row crops. This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; cool-season grasses, such as tall fescue and reed canarygrass; and warm-season grasses, such as big bluestem and switchgrass. Summer droughtiness and flooding are the main management problems. Planting species that can withstand flooding helps to sustain forage production. A good ground cover and proper streambank management can minimize scouring by streams and other kinds of flood damage. Applications of fertilizer, pasture rotation, proper stocking rates, and restricted grazing during dry periods improve forage quality and production.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

If cultivated crops are grown, the occasional flooding from late fall to early spring and droughtiness during the growing season are the major management concerns. Delayed planting may be needed to minimize the damage caused by flooding, and areas that are plowed in the fall may be subject to scouring by floodwater. A small field size and limited access restrict tillage. Winter cover crops and a conservation tillage system that leaves a protective cover of crop residue on the surface minimize flood damage and conserve moisture.

In most areas this soil is suited to habitat for openland and woodland wildlife. Grain fields, idle land, and wooded areas that border fences and drainageways provide good cover and an adequate supply of food. If grazing can be controlled or prevented, plantings of grain sorghum, grasses, legumes, shrubs, and trees in cleared areas greatly increase the food supply and improve the cover. The waste products of timber cutting and land clearing placed in dense brush piles on the adjacent uplands serve as secure winter cover for many species of wildlife.

This soil is unsuited to building site development and onsite waste disposal because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 5A.

11—Vesser silt loam. This deep, nearly level, somewhat poorly drained soil is on high flood plains. It is occasionally flooded for brief periods. Individual areas are irregular in shape and range from 20 to 160 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 10 inches thick. The subsurface layer is grayish brown, friable silt loam about 14 inches thick. The subsoil to a depth of 60 inches or more is mottled, firm silty clay loam. It is dark grayish brown in the upper part and grayish brown in the lower part. In places the dark surface layer is less than 10 inches thick. In some areas the subsoil has more clay. In other areas the soil is frequently flooded.

Included with this soil in mapping are small areas of Bremer, Dockery, and Moniteau soils. Bremer soils are poorly drained and are in landscape positions similar to those of the Vesser soil. They do not have a grayish brown subsurface layer. Dockery soils are somewhat poorly drained and are on flood plains along small streams. They do not increase in content of clay with increasing depth. Moniteau soils are poorly drained and are in landscape positions similar to those of the Vesser soil. Their surface layer is lighter colored than that of the Vesser soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Vesser soil. Surface runoff is slow. Natural fertility is medium, and the content of organic matter is moderate. The available water capacity is high. A perched water table commonly is at a depth of 1 to 3 feet in most winter and spring months. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the wetness and the flooding are limitations. Land grading, shallow surface drains, and open ditches help to remove excess water. Diversion terraces may be needed to intercept runoff from the adjacent areas. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. In some years the flooding can delay planting or harvesting.

This soil is moderately suited to shallow-rooted legumes that can withstand wetness, such as alsike clover, and to cool-season grasses, such as reed canarygrass. It is poorly suited to warm-season grasses and to hay. The wetness and the flooding are the main management problems. The hazard of flooding should be considered when grazing systems are designed. A seedbed can be easily prepared unless the soil is wet. A surface drainage system is beneficial, especially if deep-rooted species are grown.

This soil is unsuited to building site development and onsite waste disposal because of the flooding.

The land capability classification is IIw. No woodland ordination symbol is assigned.

12—Colo silty clay loam. This deep, nearly level, poorly drained soil is on flood plains along small streams. It is occasionally flooded for brief periods. Individual areas are long and narrow and range from 10 to 400 acres in size.

Typically, the surface layer is black, friable silty clay loam about 8 inches thick. The subsurface layer is very dark gray, firm silty clay loam about 11 inches thick. The subsoil to a depth of 60 inches or more is black, firm silty clay loam. In places the surface layer is overwash of silt loam. In a few areas the subsoil has more clay.

Included with this soil in mapping are small areas of Ackmore, Bremer, and Higginsville soils. Ackmore soils are stratified silt loam in the upper 20 to 36 inches. They are in areas between the Colo soil and the stream channels. Bremer soils have more clay in the subsoil than the Colo soil. They are on low stream terraces. Higginsville soils have a higher content of clay in the subsoil than the Colo soil and have a thinner dark surface layer. They are on side slopes in the uplands and on some high stream terraces. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Colo soil. Surface runoff is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is high. The seasonal high water table commonly is at a depth of 1 to 3 feet in most winter and spring months. The shrink-swell potential is moderate. The surface layer is friable, but it can become compacted and cloddy if tilled when wet.

Most areas are used for cultivated crops. A few areas are used as pasture. This soil is suited to corn, soybeans, and winter wheat. The flooding and the wetness can delay tillage in spring. Areas that are plowed in the fall may be subject to scouring by floodwater. Open ditches, shallow surface drains, and land grading help to remove excess water quickly. Levees help to prevent flooding. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is moderately suited to shallow-rooted legumes that can withstand wetness, such as alsike clover, and to cool-season grasses, such as reed canarygrass. It is poorly suited to warm-season grasses and to hay. The wetness and the flooding are the main management problems. The hazard of flooding should be considered when grazing systems are designed. A seedbed can be easily prepared only during dry periods. A surface drainage system is beneficial, especially if deep-rooted species are grown.

This soil is unsuited to building site development and onsite waste disposal because of the flooding and the wetness.

The land capability classification is IIw. No woodland ordination symbol is assigned.

13—Grable very fine sandy loam, loamy substratum. This deep, nearly level, well drained soil is on flood plains along the Missouri River. The soil is protected by levees but is subject to rare flooding because of levee breaks or runoff from the adjacent areas. Individual areas generally are long and narrow and range from 5 to more than 40 acres in size.

Typically, the surface layer is very dark grayish brown, very friable very fine sandy loam about 9 inches thick. The substratum extends to a depth of 60 inches or more. The upper part is brown, friable very fine sandy loam. The next part is grayish brown loose fine sand. The lower part is dark grayish brown, friable very fine sandy loam. In some areas the surface layer is lighter colored and is loamy fine sand or coarser sand.

Included with this soil in mapping are small areas of Leta and Sarpy soils. Leta soils are clayey in the upper part. They are in the lower areas. Sarpy soils have more sand throughout than the Grable soil. They are in landscape positions similar to those of the Grable soil. Also included, in areas between the levees and the Missouri River, are soils that are frequently flooded. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Grable soil. Surface runoff is slow. Natural fertility is high, and the content of organic matter is moderately low. The available water capacity is moderate. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops (fig. 9). This soil is suited to corn, soybeans, and winter wheat. Irrigation may be necessary during dry periods. In areas that are not irrigated, grain sorghum and alfalfa are the best suited crops. Center-pivot and traveling gun systems are the best methods of irrigation. The flooding may cause some crop loss but is not a major problem.

Figure 9.—Soybeans in an area of Grable very fine sandy loam, loamy substratum.

Restricting fall plowing and applying a conservation tillage system, such as no-till farming, that leaves a protective cover of crop residue on the surface reduce the hazard of soil blowing. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth and increases the rate of water infiltration.

This soil is suited to pasture and hay. It is well suited to most of the commonly grown legumes, such as ladino clover and red clover; cool-season grasses, such as tall fescue and reed canarygrass; and warm-season grasses, such as Caucasian bluestem and switchgrass. Droughtiness and the rare flooding are the main management problems.

This soil is suited to trees. The frequently flooded areas between the Missouri River and the levees are best suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is unsuited to building site development and onsite waste disposal because of the flooding.

The land capability classification is IIs. No woodland ordination symbol is assigned.

14—Darwin silty clay. This deep, nearly level, very poorly drained soil is on flood plains along the Missouri River. The soil is subject to rare flooding and ponding after heavy rains. Individual areas are irregular in shape and range from 5 to several hundred acres in size.

Typically, the surface layer is black, firm silty clay about 10 inches thick. The subsurface layer is very dark gray, very firm silty clay about 6 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is dark grayish brown, mottled, very firm silty clay. The next part is dark gray, mottled, firm silty clay. The lower part is very dark gray, mottled, firm silty clay loam. In places the dark surface soil is more than 24 inches thick. In a few areas the lower part of the subsoil is very fine sandy loam.

Included with this soil in mapping are a few small areas of Aholt and Leta soils. Aholt soils have more clay in the subsoil than the Darwin soil, and Leta soils have less clay in the subsoil. Aholt soils have free carbonates throughout. They are in the lower concave areas. Leta soils are somewhat poorly drained and are at the higher elevations. Included soils make up about 5 percent of the unit.

Permeability is very slow in the Darwin soil. Surface runoff is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity also is moderate. The shrink-swell potential is very high. The seasonal high water table commonly is about 1 foot above to 2 feet below the surface in most winter and spring months. The clayey surface layer can be easily tilled only within a very narrow range in moisture content. It puddles and crusts after hard rains.

Nearly all areas are used for cultivated crops. This soil is suited to soybeans and winter wheat. Corn and grain sorghum also are grown. The wetness and poor tilth are the main management problems. Because of wetness in spring and fall, the best suited row crops are those that require a short growing season. Tillage is difficult. Seedbeds should be prepared when the soil is at the optimum moisture content. Drainage by means of surface ditches or land grading and timely tillage are needed. Fall plowing improves tilth for the crops grown the following spring. 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.

This soil is suited to trees. The equipment limitation, seedling mortality, and windthrow are the main management concerns. Equipment should be used only when the soil is dry or frozen. Ridging the soil and then planting on the ridges increase the seedling survival rate. Light, frequent thinning reduces the hazard of windthrow.

This soil is well suited to habitat for wetland wildlife. The wetland plants that provide food and cover grow well. They can be naturally established in 3 to 5 years, or they can be planted by seed or rootstock. Shallow impoundments can be constructed by damming drainageways or by building berms around the intended area. Good wetland habitat consists of about 50 percent open water and 50 percent emergent vegetation. It can be attained by mowing when the area is dry or by keeping water 3.5 feet deep in half of the area and maintaining shallow water in the other half. The water depth can be adjusted by installing an outlet in the berm or dam. Opening or closing the outlet can regulate the water depth in the impoundment *(6)*.

This soil is unsuited to building site development and onsite waste disposal because of the flooding, the wetness, and the very high shrink-swell potential.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

15—Dockery silt loam. This deep, nearly level, somewhat poorly drained soil is on flood plains along small streams. It is frequently flooded for brief periods. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 9 inches thick. The substratum to a depth of 60 inches or more is friable silt loam. It is stratified dark grayish brown, very dark gray, and grayish brown in the upper part and very dark gray in the lower part. In places the surface layer is overwash of silty clay 5 to 10 inches thick.

Included with this soil in mapping are small areas of the poorly drained Moniteau and Zook soils and the somewhat poorly drained Vesser soils. Moniteau and Vesser soils are on high flood plains. Zook soils are in the lower depressional areas. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Dockery soil, and surface runoff is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is very high. The seasonal high water table commonly is at a depth of about 2 to 3 feet in most winter and spring months. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains.

Most areas are used for cultivated crops or pasture. A few areas are used as woodland. The flooding is the main hazard. It can delay tillage in spring. Areas that are plowed in the fall may be subject to scouring by floodwater. Open ditches, shallow surface drains, and land grading help to remove excess water quickly. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Grasses and legumes for hay and pasture grow well on this soil. The varieties selected for planting should be those that can withstand flooding and a high water table. The soil is moderately well suited to the commonly grown legumes, such as red clover, ladino clover, and lespedeza. It is well suited to cool-season grasses, such as reed canarygrass, and moderately well suited to tall fescue and timothy. It is moderately well suited to warm-season grasses, such as switchgrass, and moderately suited to Caucasian bluestem and indiangrass. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods improve the pasture.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is unsuited to building site development and onsite waste disposal because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 4A.

18F—Moko-Rock outcrop complex, 9 to 45 percent slopes. This unit consists of a shallow, strongly sloping to steep, somewhat excessively drained Moko soil intermingled with areas of Rock outcrop. The unit is on side slopes in the uplands. Individual areas are long and narrow and range from 5 to 20 acres in size. They are about 70 percent Moko soil and 30 percent Rock outcrop.

Typically, the surface layer of the Moko soil is very dark grayish brown, friable very flaggy silty clay loam about 2 inches thick. The subsoil is very dark grayish brown, friable very flaggy silty clay loam about 10 inches thick. Hard limestone bedrock is at a depth of about 12 inches. In a few places the soil is more than 20 inches deep over bedrock.

Included in this unit in mapping are small areas of the deep, cherty Goss soils. These soils are in landscape positions similar to those of the Moko soil. They make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Moko soil. Surface runoff is very rapid. Natural fertility is low, and the content of organic matter is moderate. The available water capacity is very low. The shrink-swell potential is moderate.

Nearly all areas of the Moko soil are used as woodland and wildlife habitat. This soil is suited to eastern redcedar. The hazard of erosion, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. Because of low production, commercial timber management may not be feasible. Water breaks may be needed to minimize erosion. Operating equipment on the steep slopes can be dangerous. Logging roads and skid trails should be built on the contour. In the steepest areas the logs should be yarded uphill to logging roads or skid trails. Reinforcement hand planting or direct seeding may be needed to increase the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

The Moko soil is suited to the development of habitat for woodland wildlife. The amount of cover for wildlife is adequate, but forage, especially acorns, is scarce. Small seeds and forage are produced by the native grasses that grow on this soil. Planting of food plots can improve the habitat. The edge of a wooded tract or another fringe area is a good site for food plots. Also, the plots can be established on the better suited adjacent soils. The habitat should be protected from grazing and fire.

The Moko soil generally is not used for building site development or onsite waste disposal because of the slope and the shallowness to bedrock.

The land capability classification is VIIs. The woodland ordination symbol is 2R in areas of the Moko soil.

21F—Goss cherty silt loam, 14 to 45 percent slopes. This deep, moderately steep and steep, well drained soil is on convex side slopes. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is dark brown cherty silt loam about 6 inches thick. The subsurface layer is yellowish brown, friable very cherty silt loam about 6 inches thick. The subsoil extends to a depth of 60 inches or more. It is yellowish red, very firm very cherty silty clay in the upper part and red, very firm very cherty clay in the lower part. In places the surface layer is not cherty. In some areas limestone bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Bluelick and Moko soils and rock outcrop. Bluelick soils do not have chert in the upper 20 to 40 inches. They are in the less sloping areas. Moko soils and rock outcrop generally are along sharp slope breaks on the lower parts of the landscape. Moko soils are shallow over bedrock. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the Goss soil. Surface runoff is rapid. Natural fertility is low, and the content of organic matter is moderately low. The available water capacity is low. The shrink-swell potential is moderate in the subsoil.

Most areas are used as woodland. Stands of native hardwoods are in several areas. A few of the less sloping areas are used as pasture.

This soil is suited to trees. Erosion and the equipment limitation are the main management concerns. Water breaks may be needed to minimize erosion. Logging roads and skid trails should be built on the contour. Because of the cherty surface layer and the slope, hand planting is needed in some areas. In the steepest areas the logs should be yarded uphill to logging roads and skid trails.

In areas that do not have cobbles or stones on the surface, this soil is suited to pasture. It is moderately suited to legumes, such as crownvetch and lespedeza; cool-season grasses, such as tall fescue; and warm-season grasses, such as Caucasian bluestem and indiangrass. It generally is unsuitable as hayland because of the slope. Droughtiness, erosion, and the chert fragments in the surface layer are the main management problems. Tillage should be avoided.

This soil is suited to the development of habitat for woodland wildlife. The amount of cover for wildlife is adequate, but forage, especially small seed grains, is scarce. Timely planting of food plots in the less cherty included areas can improve the habitat. The edge of a wooded tract or another fringe area is a good site for food plots. Also, the plots can be established on the better suited adjacent soils. The habitat should be protected from grazing and fire.

This soil generally is not used for building site development or onsite waste disposal because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

22C2—Greenton silt loam, 5 to 9 percent slopes, eroded. This deep, moderately sloping, somewhat poorly drained soil is on concave side slopes. Erosion has removed 25 to 75 percent of the original surface soil. The remaining surface layer has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to more than 140 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 9 inches thick. The subsoil is about 51 inches thick. It is dark grayish brown, mottled, firm silty clay loam and silty clay in the upper part and mottled dark grayish brown, grayish brown, yellowish brown, and light olive brown, firm silty clay in the lower part. In some severely eroded areas, the surface layer is dark grayish brown silty clay loam.

Included with this soil in mapping are small areas of Higginsville, Sampsel, and Snead soils. Higginsville soils have less clay in the subsoil than the Greenton soil. They are in landscape positions similar to those of the Greenton soil. Sampsel soils are poorly drained and are in narrow drainageways. Snead soils are moderately deep over bedrock. They are in narrow strips both above and below the Greenton soil. Included soils make up about 5 to 10 percent of the unit.

Permeability is slow in the Greenton soil. Surface runoff is medium. Natural fertility is high, and the content of organic matter is moderate. The available water capacity also is moderate. A perched high water table commonly is at a depth of about 1.5 to 3.0 feet in winter and spring. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a wide range in moisture content, but it tends to become cloddy after periods of rainfall, especially where the plow layer contains subsoil material.

Most areas are used for cultivated crops. A few areas are used for hay or pasture. This soil is suited to corn, soybeans, grain sorghum, and small grain. If cultivated crops are grown, further erosion is a hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, a combination of terraces and grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes pasture, hay, or winter wheat. A grade stabilization structure may be needed along with the grassed waterways. 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.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; cool-season grasses, such as tall fescue and timothy; and warm-season grasses, such as big bluestem, indiangrass, and switchgrass. It is moderately suited to alfalfa, orchardgrass, and smooth brome. The species that can withstand wetness grow best. Erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover minimize erosion.

This soil can be used for building site development and onsite waste disposal. The high shrink-swell potential and the wetness are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness in basements and the damage caused by wetness. The soil generally is unsuitable as a site for septic tank absorption fields because of the wetness and the slow permeability. Sewage lagoons can function adequately if the site is leveled. Alternative soils that are better suited to onsite waste disposal generally can be selected.

Low strength, the shrink-swell potential, the wetness, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

24—Haynie silt loam. This deep, nearly level, moderately well drained soil is on slightly elevated natural levees on flood plains along the Missouri River. The soil is protected by levees but is subject to rare flooding because of levee breaks or overflow from local tributaries. Individual areas generally are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 9 inches thick. The substratum extends to a depth of 60 inches or more. It is stratified grayish brown, very friable silt loam and very friable very fine sandy loam in the upper part and stratified grayish brown, mottled, very friable very fine sandy loam and brown, very friable silt loam in the lower part. In some areas, the surface layer is more than 10 inches thick and gray mottles are in the upper part of the substratum. In places the surface layer is very fine sandy loam.

Included with this soil in mapping are small areas of Grable, Levasy, and Leta soils. Grable soils have more sand than the Haynie soil. They are in landscape positions similar to those of the Haynie soil. Levasy and Leta soils are clayey in the upper part. They are in small drainageways and depressions. Also included, in areas between the levees and the Missouri River, are soils that are frequently flooded. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Haynie soil. Surface runoff is slow. Natural fertility is high, and the content of organic matter is moderately low. The available water capacity is high. The seasonal high water table is at a depth of about 3 to 6 feet in most winter and spring months. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. The flooding may cause some crop loss but is not a major management problem. Applying a conservation tillage system, such as no-till farming, that leaves a protective cover of crop residue on the surface and restricting plowing in the fall reduce the hazard of soil blowing. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth and increases the rate of water infiltration.

This soil is suited to pasture and hay. It is well suited to most of the commonly grown legumes, such as alfalfa, ladino clover, and red clover; cool-season grasses, such as tall fescue and orchardgrass; and warm-season grasses, such as big bluestem and switchgrass. The rare flooding is the main management problem.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is unsuited to building site development and onsite waste disposal because of the flooding.

The land capability classification is I. The woodland ordination symbol is 11A.

26—Haynie-Waldron complex. These deep, nearly level soils occur in an intricate pattern of swales and low natural levees adjacent to the Missouri River. The Haynie soil is moderately well drained, and the Waldron soil is somewhat poorly drained. The soils are protected by levees, but they are occasionally flooded because of levee breaks or runoff from the adjacent areas (fig. 10). The two soils occur as areas so closely intermingled that they could not be mapped separately at the scale selected for mapping. Individual areas range from 40 to more than 200 acres in size. They are about 60 percent Haynie soil and 30 percent Waldron soil.

Typically, the surface layer of the Haynie soil is a very dark grayish brown, very friable silt loam about 9 inches thick. The substratum extends to a depth of 60 inches or more. The upper part is brown, mottled, very friable very fine sandy loam. The lower part is stratified gray, grayish brown, and brown, very friable silt loam, very fine sandy loam, and loamy fine sand. In some areas the upper part of the substratum has grayish brown mottles.

Typically, the surface layer of the Waldron soil is very dark grayish brown, firm silty clay about 8 inches thick. The substratum extends to a depth of 60 inches or more. It is stratified black and very dark gray, very firm clay and silty clay in the upper part; stratified grayish brown, dark grayish brown, and very dark gray, friable silt loam and very firm silty clay in the next part; and stratified dark gray and very dark grayish brown, firm silty clay loam in the lower part. In some areas the substratum is grayer. In places the surface layer is silty clay loam.

Included with these soils in mapping are areas of Grable, Leta, and Moville soils. Grable soils are well drained and are in the slightly higher areas. They have more sand throughout than the Haynie and Waldron soils. Leta soils are clayey in the upper part and loamy in the lower part. They are between areas of the Waldron and Haynie soils. Moville soils are loamy in the upper part and clayey in the lower part. They are in landscape positions similar to those of the Haynie soil. Also included, in areas between the levees and the Missouri River, are soils that are frequently flooded. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Haynie soil and slow in the Waldron soil. Surface runoff is slow on both soils. Natural fertility is high. The content of organic matter is moderately low in the Haynie soil and moderate in the Waldron soil. The available water capacity is high in the Haynie soil and moderate in the Waldron soil. In winter and spring, the Waldron soil commonly has a seasonal high water table at a depth of 1 to 3 feet and the Haynie soil commonly has one at a depth of 3 to 6 feet. The shrink-swell potential is high in the Waldron soil

Figure 10.—Flooding on the Waldron soil in a cultivated area of the Haynie-Waldron complex.

and low in the Haynie soil. The Haynie soil is friable and can be easily tilled throughout a wide range in moisture content. The Waldron soil is firm when dry and sticky when wet and can be easily tilled only within a narrow range in moisture content.

Nearly all areas are used for cultivated crops. These soils are suited to soybeans, corn, winter wheat, and grain sorghum. The wetness of the Waldron soil is the major limitation. Land grading, shallow surface drains, and open ditches are needed to improve drainage. Returning crop residue to the soil or regularly adding other organic material improves tilth, minimizes crusting, and increases the rate of water infiltration. No major limitations or hazards affect cropping on the Haynie soil.

Most areas between the levees and the river channel are used as woodland. These soils are suited to trees. Seedling mortality and the equipment limitation are the main management problems on the Waldron soil. Reinforcement planting or the selection of container-grown nursery stock for planting increases the seedling survival rate. Equipment should be used only when the soils are dry or frozen.

These soils are unsuited to building site development and onsite waste disposal because of the flooding and the wetness.

The land capability classification is IIw. The woodland ordination symbol is 11A in areas of the Haynie soil and 11C in areas of the Waldron soil.

30B—Higginsville silt loam, 2 to 5 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on slightly rounded ridgetops and, to a limited extent, on the more nearly level parts of high stream terraces. Individual areas are broad and circular and range from 5 to 100 acres in size.

Typically, the surface layer is black, very friable silt loam about 9 inches thick. The subsurface layer also is black, very friable silt loam. It is about 10 inches thick. The subsoil is silty clay loam about 29 inches thick. It is very dark grayish brown and friable in the upper part;

dark grayish brown, mottled, and firm in the next part; and grayish brown and light brownish gray, mottled, and firm in the lower part. The substratum to a depth of 60 inches or more is light brownish gray, mottled, firm silty clay loam. In places the slope is more than 5 percent. In a few areas the subsoil has more clay.

Included with this soil in mapping are small areas of the well drained Sibley soils. These soils are on the ends of ridges and in convex areas. They make up about 5 percent of the unit.

Permeability is moderate in the Higginsville soil. Surface runoff is medium. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is high. A perched water table commonly is at a depth of 1.5 to 3.0 feet in most winter and spring months. The shrink-swell potential is moderate in the subsoil. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains.

Most areas are used for cultivated crops. A few areas are used for hay or pasture. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, erosion is a hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, and a combination of terraces and grassed waterways or tile outlets. Contour farming and a conservation cropping system that includes pasture, hay, or small grain also help to control erosion. A grade stabilization structure may be needed along with the grassed waterways. Properly installed drainage tile is needed in the wet and seepy areas. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; cool-season grasses, such as tall fescue and timothy; and warm-season grasses, such as big bluestem, indiangrass, and switchgrass. It is moderately suited to alfalfa, orchardgrass, and smooth brome. The species that can withstand wetness grow best. Erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover minimize erosion.

This soil can be used for building site development and onsite waste disposal. The moderate shrink-swell potential and the wetness are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness in basements and the damage caused by wetness.

This soil generally is unsuitable as a site for septic tank absorption fields because of the wetness. The septic tank system can function adequately, however, if perimeter drains are installed around the absorption field to lower the water table and the site is mounded or otherwise elevated with suitable fill material. Sewage lagoons can function adequately if the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent contamination of the ground water. Alternative soils that are better suited to onsite waste disposal generally can be selected.

Low strength, the shrink-swell potential, the wetness, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

30C2—Higginsville silt loam, 5 to 9 percent slopes, eroded. This deep, moderately sloping, somewhat poorly drained soil is on slightly concave side slopes. Erosion has removed 25 to 75 percent of the original surface soil. The remaining surface layer has been mixed with the subsurface layer and the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 12 inches thick. The subsoil is brown and grayish brown, mottled, firm silty clay loam about 32 inches thick. The substratum to a depth of 60 inches or more is grayish brown, mottled, firm silty clay loam. In places the soil has a surface layer of dark silty clay loam less than 10 inches thick and a slope of more than 9 percent. In a few areas the subsoil has more clay.

Included with this soil in mapping are small areas of the poorly drained Sampsel soils and the well drained Sibley soils. Sampsel soils have more clay than the Higginsville soil. They are on the lower parts of the side slopes. Sibley soils are in convex areas. Included soils make up about 5 percent of the unit.

Permeability is moderate in the Higginsville soil. Surface runoff is medium. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is high. A perched water table commonly is at a depth of 1.5 to 3.0 feet during most winter and spring months. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains, especially where the plow layer contains subsoil material.

Most areas are used for cultivated crops. A few areas are used for hay or pasture. This soil is suited to corn, soybeans, grain sorghum, and small grain (fig. 11). If cultivated crops are grown, further erosion is a hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, a combination of terraces and grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes pasture, hay, or small grain. A grade stabilization structure may be needed along with the grassed waterways. In the wet and seepy areas, properly installed tile drains are needed. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; cool-season grasses, such as tall fescue and timothy; and warm-season grasses, such as big bluestem, indiangrass, and switchgrass. It is moderately suited to alfalfa, orchardgrass, and smooth brome. The species that can withstand wetness grow best. Erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover minimize erosion.

This soil can be used for building site development and onsite waste disposal. The moderate shrink-swell potential and the wetness are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness in basements and the damage caused by wetness. Some land grading generally is needed to modify the slope.

This soil generally is unsuitable as a site for septic tank absorption fields because of the wetness. The septic tank system can function adequately, however, if perimeter drains are installed around the absorption field to lower the water table and the site is mounded or otherwise elevated with suitable fill material. Sewage lagoons can function adequately if the site is leveled and the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent contamination of the ground water. Alternative soils that are better suited to onsite waste disposal generally can be selected.

Low strength, the shrink-swell potential, the wetness, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

33C—Knox silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, well drained soil is on the tops of ridges on uplands adjacent to flood plains along the Missouri River. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsurface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 35 inches thick. It is dark yellowish brown, friable silt loam in the upper part and dark yellowish brown, firm silty clay loam in the lower part. The substratum to a depth of 60 inches or more is dark yellowish brown, friable silt loam. In some areas the surface layer has been mixed with the subsoil and is silty clay loam. In other areas the dark surface layer is thicker.

Included with this soil in mapping are areas of Sibley and Weller soils. Sibley soils are dark to a depth of more than 24 inches. They are on the wider ridgetops. Weller soils have a light colored surface layer and have more clay in the subsoil than the Knox soil. They are at the head of drainageways. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Knox soil. Surface runoff is medium. Natural fertility also is medium, and the content of organic matter is moderately low. The available water capacity is high. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after hard rains.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, erosion is hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, and a combination of

Figure 11.—Grassed waterways in a field of corn in an area of Higginsville silt loam, 5 to 9 percent slopes, eroded.

terraces, grassed waterways or tile outlets, and a grade stabilization structure. Contour farming and a conservation cropping system that includes pasture, hay, or small grain also are effective in controlling erosion. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; warm-season grasses, such as big bluestem, indiangrass, and switchgrass; and cool-season grasses, such as smooth brome and orchardgrass. No serious management problems affect hayland or pasture. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development and onsite waste disposal. The moderate shrink-swell potential is a limitation on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand and gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to remove excess water. Septic tank absorption fields can function adequately if installed properly. Sewage lagoons can function adequately if the site is leveled and if the bottom and berms of the lagoons are sealed with slowly permeable material, which helps to prevent seepage.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Constructing adequate roadside ditches and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

33C2—Knox silt loam, 3 to 9 percent slopes, eroded. This deep, gently sloping and moderately sloping, well drained soil is on the tops of ridges on uplands adjacent to flood plains along the Missouri River. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the subsurface layer and the upper part of the subsoil. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 30 inches thick. It is brown, firm silt loam in the upper part and dark yellowish brown, firm silty clay loam in the lower part. The substratum to a depth of 60 inches or more is dark yellowish brown, friable silt loam. In some severely eroded areas, the surface layer has been mixed with the subsoil.

Included with this soil in mapping are small areas of Weller soils. These soils have a light colored surface layer and have more clay in the subsoil than the Knox soil. They are at the head of drainageways. They make up about 5 percent of the unit.

Permeability is moderate in the Knox soil. Surface runoff is medium. Natural fertility also is medium, and the content of organic matter is moderately low. The available water capacity is high. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. It tends to puddle or crust, however, after hard rains, especially where the plow layer has been mixed with the subsoil.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, further erosion is a severe hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, and a combination of terraces, grassed waterways or tile outlets, and a grade stabilization structure. Contour farming and a conservation cropping system that includes pasture, hay, or small grain also are effective in controlling erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; cool-season grasses, such as smooth brome and orchardgrass; and warm-season grasses, such as big bluestem, indiangrass, and switchgrass. No serious management problems affect pasture or hayland. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development and onsite waste disposal. The shrink-swell potential is a limitation on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand and gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to remove excess water. Septic tank absorption fields can function adequately if installed properly. Sewage lagoons can function adequately if the site is leveled and if the berms and bottom of the lagoons are lined with slowly permeable material, which helps to prevent seepage.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base. Constructing adequate roadside ditches and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

33D2—Knox silt loam, 9 to 14 percent slopes, eroded. This deep, strongly sloping, well drained soil is on side slopes on uplands adjacent to flood plains along the Missouri River. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the subsurface layer and the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is dark yellowish brown, firm silty clay loam about 30 inches thick. The substratum to a depth of 60 inches or more is dark yellowish brown, mottled, friable silty clay loam. In some severely eroded areas, the surface layer has been mixed with the subsoil. In places the slope is more than 14 percent.

Included with this soil in mapping are small areas of Weller soils. These soils have a light colored surface layer and have more clay in the subsoil than the Knox soil. They are at the head of drainageways. They make up about 5 percent of the unit.

Permeability is moderate in the Knox soil. Surface runoff is rapid. Natural fertility is medium, and the content of organic matter is moderately low. The available water capacity is high. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after hard rains, especially where the plow layer has been mixed with the subsoil.

Most areas are used as cropland, pasture, or hayland (fig. 12). A few areas are wooded. This soil is suited corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, further erosion is a severe hazard. The measures used to control erosion on this

Figure 12.—Alfalfa cut for hay in an area of Knox silt loam, 9 to 14 percent slopes, eroded.

soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, and a combination of terraces, grassed waterways or tile outlets, and a grade stabilization structure. Contour farming and a conservation cropping system that includes pasture or hay also is effective in controlling erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; cool-season grasses, such as smooth brome and orchardgrass; and warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Erosion is a major hazard in newly seeded areas. Overgrazing should be avoided. Seedbeds should be prepared on the contour. Measures that maintain fertility and control brush are needed.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development and onsite waste disposal. The slope and the shrink-swell potential are moderate limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to remove excess water. Some land shaping may be needed because of the slope. Otherwise, the dwellings can be designed so that they conform to the natural slope of the land. Septic tank absorption fields can function adequately if the distribution lines are installed across the slope.

Low strength, the shrink-swell potential, frost action, and the slope limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Constructing adequate roadside ditches and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action. Some cutting and filling may be needed because of the slope.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

33F—Knox silt loam, 14 to 35 percent slopes. This deep, moderately steep and steep, well drained soil is on strongly dissected hills and bluffs bordering the valley of the Missouri River. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is brown, friable silt loam about 4 inches thick. The subsoil is about 25 inches of yellowish brown, friable silt loam and dark yellowish brown, friable silty clay loam. The substratum to a depth of 60 inches or more is dark yellowish brown, friable silt loam. In places the dark surface layer is thicker. In some severely eroded areas, erosion has removed most of the original surface layer.

Included with this soil in mapping are small areas of the somewhat poorly drained Dockery soils and the moderately well drained Snead soils. Dockery soils are on narrow flood plains. Snead soils are in the steeper areas. Included soils make up about 5 percent of the unit.

Permeability is moderate in the Knox soil. Surface runoff is rapid. Natural fertility is medium, and the content of organic matter is moderately low. The available water capacity is high. The shrink-swell potential is moderate in the subsoil.

Most areas are wooded. Stands of native hardwoods are in several areas. Some small areas are used as pasture. A few areas are used as cropland.

This soil is suited to trees. The hazard of erosion, the equipment limitation, and seedling mortality are the main management concerns. The slope severely limits the use of planting and harvesting equipment. In the steepest areas the logs should be yarded uphill to logging roads and skid trails. Building the logging roads and skid trails on the contour helps to control erosion and ensure the safe operation of equipment. Hand planting of seedlings is needed in some areas. Planting container-grown nursery stock or reinforcement planting increases the seedling survival rate.

The less sloping areas of this soil are suited to pasture. The soil is well suited to most of the commonly grown legumes, such as alfalfa, ladino clover, and red clover; cool-season grasses, such as tall fescue, orchardgrass, and timothy; and warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management problems. Seedbeds should be prepared on the contour. Timely seedbed preparation helps to ensure rapid plant growth and thus a good ground cover. Because of the slope and a severe hazard of erosion, care is needed in reestablishing pasture. A conservation tillage system that leaves a protective cover of crop residue on the surface helps to control erosion when the pasture is renovated. Overgrazing should be avoided. Measures that maintain fertility and control brush are needed.

This soil generally is not used for building site development or onsite waste disposal because of the slope.

The land capability classification is VIe. The woodland ordination symbol is 4R.

33F2—Knox silt loam, 14 to 35 percent slopes, eroded. This deep, moderately steep and steep, well drained soil is on strongly dissected hills and bluffs bordering the valley of the Missouri River. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the subsurface layer and the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to 60 acres in size.

Typically, the surface layer is mixed dark brown and dark yellowish brown, very friable silt loam about 7 inches thick. The subsoil is about 33 inches thick. It is dark yellowish brown, firm silty clay loam in the upper part and dark yellowish brown, friable silt loam in the lower part. The substratum to a depth of 60 inches or more is dark yellowish brown, very friable silt loam. In some severely eroded areas, erosion has removed the original surface layer.

Included with this soil in mapping are small areas of the somewhat poorly drained Dockery soils and the moderately well drained Snead soils. Dockery soils are on narrow flood plains. Snead soils are in the steeper areas. Included soils make up about 5 percent of the unit.

Permeability is moderate in the Knox soil. Surface runoff is rapid. Natural fertility is medium, and the content of organic matter is moderately low. The available water capacity is high. The shrink-swell potential is moderate in the subsoil.

Most areas are used as pasture. Some small areas are wooded. A few areas are used as cropland.

This soil is suited to pasture. It is well suited to most of the commonly grown legumes, such as alfalfa, ladino clover, and red clover; cool-season grasses, such as tall fescue, orchardgrass, and timothy; and warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management problems. Seedbeds should be prepared on the contour. Timely seedbed preparation helps to ensure rapid plant growth and thus a good ground cover. Because of the slope and a severe hazard of erosion, care is needed in reestablishing pasture. A conservation tillage system that leaves a protective cover of crop residue on the surface helps to control erosion when the pasture is renovated. Overgrazing should be avoided. Measures that maintain fertility and control brush are needed.

This soil is suited to trees. The hazard of erosion, the equipment limitation, and seedling mortality are the main management concerns. Water breaks may be needed to control erosion on logging roads and skid trails. Operating planting and harvesting equipment can be hazardous on the steeper slopes. The logs should be yarded uphill to logging roads and skid trails. Building the roads and skid trails on the contour helps to control erosion and ensure the safe operation of equipment. Hand planting of seedlings is needed in some areas. Planting container-grown nursery stock or reinforcement planting increases the seedling survival rate.

This soil generally is not used for building site development or onsite waste disposal because of the slope.

The land capability classification is VIe. The woodland ordination symbol is 4R.

36C2—Ladoga silt loam, 3 to 9 percent slopes, eroded. This deep, gently sloping and moderately sloping, moderately well drained soil is on convex ridgetops and the round parts of high terraces. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the subsurface layer and the upper part of the subsoil. Individual areas are generally long and narrow and range from 5 to 50 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is dark yellowish brown silty clay loam about 28 inches thick. The upper part is friable, and the lower part is mottled and firm. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm silty clay loam. In some areas, the surface layer is browner and the subsoil redder. In a few places the dark surface layer is more than 10 inches thick.

Included with this soil in mapping are small areas of Macksburg and Weller soils. Macksburg soils have a gray, mottled subsoil. They are on ridgetops above the Ladoga soil. Weller soils have a light colored surface layer and a gray, mottled subsoil. They are on convex side slopes below the Ladoga soil. Included soils make up about 5 percent of the unit.

Permeability is moderately slow in the Ladoga soil. Surface runoff is medium. Natural fertility also is medium, and the content of organic matter is moderate. The available water capacity is high. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after hard rains.

Most areas are used for cultivated crops or pasture. This soil is suited to corn, soybeans, and winter wheat. If cultivated crops are grown, further erosion is a severe hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface and a combination of terraces, grassed waterways or tile outlets, and a grade stabilization structure. Winter cover crops, contour farming, and a conservation cropping system that includes pasture, hay, or small grain also are effective in controlling 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.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; cool-season grasses, such as smooth brome, orchardgrass, and tall fescue; and warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. No serious management problems affect pasture or hayland. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover.

A few small areas support native hardwoods. This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suited to building site development and onsite waste disposal. The shrink-swell potential is a limitation on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Because of the moderately slow permeability, conventional septic tank absorption fields cannot function adequately on this soil. Sewage lagoons can function adequately if the site is leveled and the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent seepage.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

37A—Leslie silt loam, 0 to 2 percent slopes. This deep, nearly level, poorly drained soil is in depressions on high terraces. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 14 inches thick. The subsurface layer is dark grayish brown, mottled, very friable silt loam about 10 inches thick. The subsoil is about 28 inches thick. The upper part is dark grayish brown, mottled, firm silty clay loam. The next part is dark grayish brown, mottled, very firm silty clay. The lower part is light brownish gray, mottled, firm silty clay loam. The substratum to a depth of 60 inches or more is light brownish gray, mottled, firm silt loam. In places the subsoil has less clay.

Included with this soil in mapping are small areas of Joy and Winterset soils. Joy soils have less clay than the Leslie soil. They are in the rounder areas. Winterset soils do not have a dark grayish brown, leached subsurface layer and have less clay than the Leslie soil. They are in landscape positions similar to those of the Leslie soil. Included soils make up about 10 percent of the unit.

Permeability is slow in the Leslie soil. Surface runoff also is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is high. A perched water table commonly is at a depth of 1 to 2 feet in most winter and spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled at the optimum moisture content, but it becomes cloddy if worked when too wet and tends to crust or puddle after hard rains.

Most areas are used for cultivated crops. A few areas are used for pasture or hay. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If row crops are grown, the wetness and the hazard of soil blowing are the main management concerns. Land grading, shallow surface drains, and open ditches help to remove excess water. Restricting fall plowing and applying a conservation tillage system, such as no-till farming, that leaves a protective cover of crop residue on the surface help to control soil blowing. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to pasture and hay. It is moderately suited to shallow-rooted legumes that can withstand wetness, such as ladino clover and alsike clover, and to cool-season grasses, such as reed canarygrass. It is poorly suited to warm-season grasses. The wetness is the main management concern. Maintaining stands of desirable species is difficult in depressions. A surface drainage system is beneficial, especially if deep-rooted species are grown.

This soil generally is not used for building site development or onsite waste disposal because of the wetness and the high shrink-swell potential. Alternative soils that are better suited to these uses generally are available in nearby areas.

The land capability classification is IIw. No woodland ordination symbol is assigned.

37B—Leslie silt loam, 2 to 5 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on the tops of ridges on uplands. Individual areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 15 inches thick. The subsurface layer is grayish brown, friable silt loam about 7 inches thick. The subsoil is about 38 inches thick. The upper part is dark grayish brown, mottled, firm silty clay loam. The next part is dark grayish brown, mottled silty clay. The lower part is mottled dark grayish brown and grayish brown, firm silty clay loam. In places the dark surface layer is less than 10 inches thick.

Included with this soil in mapping are small areas of the well drained Ladoga soils and the moderately well drained Weller soils. Ladoga soils are on the ends of ridges and in convex areas. Weller soils are on the steeper side slopes. Included soils make up about 10 percent of the unit.

Permeability is slow in the Leslie soil. Surface runoff also is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is high. A perched water table commonly is at a depth of 1 to 2 feet in most winter and spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled at the optimum moisture content, but it becomes cloddy if worked when too wet and tends to crust or puddle after hard rains.

Most areas are used for cultivated crops. A few areas are used for pasture or hay (fig. 13). This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, erosion is a hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface and a combination of terraces, grassed waterways or tile outlets, and a grade stabilization structure. Contour farming, winter cover crops, and a conservation cropping system that includes pasture, hay, or small grain also help to control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and

Figure 13.—Soybeans and cool-season grasses grown for hay in an area of Leslie silt loam, 2 to 5 percent slopes.

increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to the commonly grown legumes, such as ladino clover and lespedeza; cool-season grasses, such as timothy and tall fescue; and warm-season grasses, such as big bluestem and indiangrass. The species that can withstand wetness grow best. Erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to control erosion.

This soil generally is not used for building site development or onsite waste disposal because of the wetness and the high shrink-swell potential. Alternative soils that are better suited to these uses generally are available in nearby areas.

The land capability classification is IIe. No woodland ordination symbol is assigned.

40—Leta silty clay. This deep, nearly level, somewhat poorly drained soil is on flood plains along the Missouri River. The soil is protected by levees, but it is still occasionally flooded. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, firm silty clay about 3 inches thick. The subsurface layer is very dark gray, very firm silty clay about 10 inches thick. The subsoil is dark grayish brown, very firm silty clay about 24 inches thick. It is mottled in the lower part. The substratum to a depth of 60 inches or more is grayish brown, mottled, very friable very fine sandy loam. In some places the dark surface soil is less than 10 inches thick. In other places the subsoil does not have free carbonates.

Included with this soil in mapping are small areas of Haynie and Waldron soils. Haynie soils do not have silty clay in the upper part. They are at the slightly higher elevations. Waldron soils have more clay in the substratum than the Leta soil. They are in landscape positions similar to those of the Leta soil. Included soils make up about 10 percent of the unit.

Permeability is slow in the clayey upper part of the Leta soil and moderate in the loamy lower part. Surface runoff is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity also is moderate. The seasonal high water table is at a depth of about 1 to 3 feet in most winter and spring months. The shrink-swell potential is high in the clayey upper part of the soil and low in the loamy lower part. The surface layer is firm and can be easily tilled only within a narrow range in moisture content. It becomes cloddy if tilled when wet.

Most areas are used for cultivated crops. This soil is suited to soybeans, grain sorghum, corn, and winter wheat. In places, surface runoff is very slow and the surface is ponded after hard rains or after the soil receives runoff from the adjacent areas. Land grading, shallow surface drains, and open ditches help to remove excess surface water. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. The equipment limitation, seedling mortality, and the hazard of windthrow are the main management concerns. Equipment should be used only when the soil is dry or frozen. Ridging the soil and then planting on the ridges increase the seedling survival rate. Areas of this soil should be thinned more frequently and less intensively than areas where the hazard of windthrow is slight.

This soil is unsuitable for building site development and onsite waste disposal because of the flooding and the wetness.

The land capability classification is IIw. The woodland ordination symbol is 7W.

41—Levasy silty clay. This deep, nearly level and slightly depressional, poorly drained soil is on flood plains along the Missouri River. The soil is protected by levees but is still occasionally flooded by local tributaries or because of levee breaks. Ponding is common after heavy rains. Individual areas are long and narrow and range from 10 to more than 100 acres in size.

Typically, the surface layer is black, firm silty clay about 4 inches thick. The subsurface layer also is black, firm silty clay. It is about 8 inches thick. The subsoil is dark gray and grayish brown, mottled, firm silty clay about 24 inches thick. The substratum to a depth of 60 inches or more is olive gray, mottled, very friable very fine sandy loam. In some areas the black surface soil is less than 10 inches thick. In places the clayey layers extend to a depth of more than 38 inches.

Included with this soil in mapping are small areas of Haynie and Waldron soils. Haynie soils are loamy throughout. They are higher on the landscape than the Levasy soil. Waldron soils consist of stratified loamy and clayey material throughout. They are in landscape positions similar to those of the Levasy soil. Included soils make up 5 to 10 percent of the unit.

Permeability is slow in the clayey upper part of the Levasy soil and moderate in the loamy lower part. Surface runoff is very slow or ponded. Natural fertility is high, and the content of organic matter is moderate. The available water capacity also is moderate. The seasonal high water table commonly is above the surface or within a depth of 1.5 feet in most winter and spring months. The shrink-swell potential is high in the clayey upper part of the soil and low in the loamy lower part. The clayey surface layer can be easily tilled only within a narrow range in moisture content. It crusts or puddles after hard rains.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, winter wheat, and grain sorghum. The wetness is the main management problem. The flooding usually is not a major management problem. Open ditches, shallow surface drains, and land grading help to remove excess water. Fall plowing improves tilth for the crops grown the following spring. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. The equipment limitation, seedling mortality, and the hazard of windthrow are the main management concerns. Equipment should be used only when the soil is dry or frozen. Ridging the soil and then planting on the ridges increase the seedling survival rate. Light, frequent thinning reduces the hazard of windthrow.

This soil is well suited to wetland wildlife habitat. The wetland plants that provide food and cover for wildlife grow well. They can be naturally established in 3 to 5 years, or they can be planted by seed or rootstock. Shallow impoundments can be constructed by damming drainageways or by building berms around the intended area. Good wetland habitat consists of about 50 percent open water and 50 percent emergent vegetation. It can be attained by mowing when the area is dry or by keeping water 3.5 feet deep in half of the area and maintaining a cover of shallow water in the other half. The water depth can be adjusted by installing an outlet in the berm or dam. Opening or closing the outlet can regulate the water depth in the impoundment *(6)*.

This soil is unsuited to building site development and onsite waste disposal because of the flooding and the wetness.

The land capability classification is IIIw. The woodland ordination symbol is 7W.

42F—Plainfield loamy sand, 14 to 35 percent slopes. This deep, moderately steep and steep, excessively drained soil is in strongly dissected areas adjacent to Salt Fork Creek. Individual areas are irregular in shape and range from 5 to about 40 acres in size.

Typically, the surface layer is very dark grayish brown, very friable loamy sand about 4 inches thick. The subsurface layer is yellowish brown, very friable sand about 10 inches thick. The subsoil is loose sand about 38 inches thick. The upper part is very pale brown, and the lower part is brownish yellow and very pale brown. The substratum to a depth of 60 inches or more is very pale brown, loose sand. In some areas the subsoil has more silt and more clay.

Included with this soil in mapping are small areas of the moderately well drained Lindley and Winfield soils. These soils are in the less sloping areas at the higher elevations. They make up about 5 percent of the unit.

Permeability is rapid in the Plainfield soil. Surface runoff is slow. Natural fertility and the content of organic matter are low. The available water capacity also is low.

All areas are used as woodland. This soil is suited to trees. The hazard of erosion, the equipment limitation, and seedling mortality are the main management concerns. Carefully designing logging roads and skid trails minimizes the steepness and length of slopes and the concentration of surface water. The roads and skid trails should be built on the contour. Constructing water breaks and seeding disturbed areas after the trees are harvested minimize erosion. Operating equipment on the steep slopes can be hazardous. In the steepest areas the logs should be yarded uphill to logging roads or skid trails. Hand planting of seedlings may be needed. Reinforcement planting reduces the seedling mortality rate.

This soil generally is not used for building site development or onsite waste disposal because of the slope.

The land capability classification is VIIs. The woodland ordination symbol is 3R.

43B—Macksburg silt loam, 1 to 4 percent slopes. This deep, very gently sloping, somewhat poorly drained soil is on ridgetops and high stream terraces. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is black, very friable silt loam about 8 inches thick. The subsurface layer is very dark gray, friable silt loam about 7 inches thick. The subsoil to a depth of 60 inches or more is firm silty clay loam. It is very dark grayish brown in the upper part, dark grayish brown and mottled in the next part, and mottled grayish brown, yellowish brown, and strong brown in the lower part. In places the dark surface soil is less than 16 inches thick. In some areas the subsoil has less clay. In a few areas the slope is more than 4 percent.

Included with this soil in mapping are small areas of Leslie, Sampsel, and Sibley soils. Leslie soils have a light colored subsurface layer. They are in depressions. Sampsel soils are poorly drained and are in drainageways and the steeper areas. Sibley soils are well drained and are in the higher convex areas. Included soils make up 2 to 10 percent of the unit.

Permeability is moderately slow in the Macksburg soil. Surface runoff is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is high. A perched water table commonly is at a depth of about 2 to 4 feet in most winter and spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled at the optimum moisture content, but it becomes cloddy if worked when too wet and tends to crust or puddle after hard rains.

Most areas are used for cultivated crops (fig. 14). A few small areas are used for hay or pasture. This soil is well suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, erosion is a hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, and a combination of terraces and grassed waterways or tile outlets. A conservation cropping system that includes pasture, hay, or small grain also helps to control erosion. A grade stabilization structure may be needed along with the grassed waterways. Nearly all areas have slopes that are long enough to be terraced and farmed on the contour. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; cool-season grasses, such as tall fescue and timothy; and warm-season grasses, such as big bluestem, indiangrass, and switchgrass. It is moderately suited to alfalfa, orchardgrass, and smooth brome. The species that can withstand wetness grow best. Erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

This soil can be used for building site development and onsite waste disposal. The high shrink-swell potential and the wetness are limitations on sites for dwellings. Footings, foundations, and basement walls

Figure 14.—Soybeans nearing maturity in an area of Macksburg silt loam, 1 to 4 percent slopes.

should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness in basements and the damage caused by wetness. Because of the moderately slow permeability and the wetness, the soil is unsuitable as a site for conventional septic tank absorption fields. Sewage lagoons can function adequately if the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent contamination of the ground water.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

44C2—Arispe silt loam, 4 to 9 percent slopes, eroded. This deep, moderately sloping, somewhat poorly drained soil is on concave side slopes. Erosion has removed 25 to 75 percent of the original surface soil. The remaining surface layer has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to more than 50 acres in size.

Typically, the surface layer is black, friable silt loam about 6 inches thick. The subsoil is about 44 inches thick. It is very dark gray, friable silty clay loam in the upper part; dark grayish brown, mottled, firm silty clay in the next part; and grayish brown, mottled, firm silty clay loam in the lower part. The substratum to a depth of 60 inches or more is light brownish gray, mottled, firm silty clay loam. In places the dark surface layer is more than 10 inches thick. In some severely eroded areas, the surface layer is silty clay loam.

Included with this soil in mapping are small areas of the poorly drained Sampsel soils. These soils are in narrow drainageways. They make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Arispe soil. Surface runoff is medium. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is high. A perched water table commonly is at a depth of about 2 to 4 feet in most winter and spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle or become cloddy, however, after periods of rainfall, especially where the plow layer contains subsoil material.

Most areas are used for cultivated crops. A few areas are used for hay or pasture (fig. 15). This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, erosion is a hazard. No-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, and a combination of terraces and grassed waterways or tile outlets help to control erosion. Contour farming and a conservation cropping system that includes pasture, hay, or small grain also help to control erosion. A grade stabilization structure may be needed along with the grassed waterways. In the wet and seepy areas, properly installed tile drains are needed. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; cool-season grasses, such as tall fescue and timothy; and warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. It is moderately suited to alfalfa, orchardgrass, and smooth brome. The species that can withstand wetness grow best. Erosion control during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to control erosion.

This soil can be used for building site development and onsite waste disposal. The shrink-swell potential, the wetness, and the slope are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness in basements and the damage caused by wetness. Some land grading generally is needed to modify the slope. Because of the moderately slow permeability and the wetness, the soil is unsuitable as a site for conventional septic tank absorption fields. Sewage lagoons can function adequately if the site is leveled and the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent contamination of the ground water.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

44D2—Arispe silt loam, 9 to 14 percent slopes, eroded. This deep, strongly sloping, somewhat poorly drained soil is on concave side slopes. Erosion has removed 25 to 75 percent of the original surface soil. The remaining surface layer has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to more than 50 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 8 inches thick. The subsoil is firm silty clay loam about 36 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The substratum to a depth of 60 inches or more is grayish brown, firm silty clay loam. In some severely eroded areas, the surface layer is silty clay loam. In some places the soil is less sloping. In other places it is underlain by gray clay.

Included with this soil in mapping are small areas of Weller and Sibley soils. Weller soils have a light colored surface layer. They are in landscape positions similar to those of the Arispe soil. Sibley soils are well drained and are in areas above the Arispe soil. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Arispe soil. Surface runoff is medium. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is high. A perched water table commonly is at a depth of about 2 to 4 feet in most winter and spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle or become cloddy, however, after periods of rainfall, especially where the plow layer contains subsoil material.

Most areas are used for cultivated crops. A few areas are used for hay or pasture. This soil is suited to cultivated crops only if the crops are grown on a limited basis in rotation with pasture or hay crops. If cultivated crops are grown, erosion is a severe hazard. No-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface helps to control erosion. Winter cover crops, a

Figure 15.—Tall fescue hay in an area of Arispe silt loam, 4 to 9 percent slopes, eroded.

combination of terraces and grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes pasture, hay, or small grain also help to control erosion. A grade stabilization structure may be needed along with the grassed waterways. In the wet and seepy areas, properly installed drainage tile is needed. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is moderately well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; cool-season grasses, such as tall fescue and timothy; and warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Erosion is the main management problem. A good ground cover is needed at all times if production is to be maintained. Nurse crops provide a protective cover in newly seeded areas. Timely tillage is needed. The soil should be tilled on the contour. No-till seeding methods help to protect the surface.

This soil is suitable for building site development and onsite waste disposal. The shrink-swell potential, the wetness, and the slope are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness in basements and the damage caused by wetness. Land grading is needed to modify the slope. Because of the moderately slow permeability and the wetness, the soil is unsuitable as a site for conventional septic tank absorption fields. Sewage lagoons can function adequately if the site is leveled and the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent contamination of the ground water.

Low strength, the shrink-swell potential, the wetness, frost action, and the slope limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action. Some cutting and filling may be needed. Otherwise, the roads can be designed so that they conform to the natural slope of the land.

The land capability classification is IVe. No woodland ordination symbol is assigned.

45C2—Mandeville silt loam, 5 to 9 percent slopes, eroded. This moderately deep, moderately sloping, moderately well drained soil is on side slopes in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the subsurface layer and the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 26 inches thick. It is dark yellowish brown, firm silty clay loam in the upper part; dark yellowish brown and yellowish brown, firm channery silty clay loam in the next part; and mottled yellowish brown and light olive gray, firm channery silty clay loam in the lower part. Below this to a depth of 60 inches or more is soft shale bedrock. In some areas the soil is deeper over shale bedrock. In other areas fewer shale fragments are throughout the profile.

Included with this soil in mapping are small areas of Greenton and Weller soils. These soils are on side slopes above the Mandeville soil. Greenton soils are deep and somewhat poorly drained and have a dark surface layer. Weller soils are deep and have more clay in the subsoil than the Mandeville soil. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Mandeville soil. Surface runoff is medium. Natural fertility and the content of organic matter are moderately low. The available water capacity is low. A perched water table commonly is at a depth of about 2 to 3 feet in most winter and spring months. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used as pasture or hayland. A few areas are used for row crops. A few small areas are wooded.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to legumes, such as lespedeza and birdsfoot trefoil; cool-season grasses, such as tall fescue and orchardgrass; and warm-season grasses, such as big bluestem and indiangrass. The moderate rooting depth and droughtiness during much of the year are management problems. Erosion is a major hazard in newly seeded areas. Timely tillage and a quickly established ground cover help to control erosion.

This soil is suited to long rotations of close-growing forage crops in which cultivated crops are grown infrequently. If cultivated crops are grown, erosion is a severe hazard. A conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, grassed waterways, and a conservation cropping system that includes close-growing pasture or hay crops help to control erosion. A grade stabilization structure generally is needed along with the grassed waterways. Returning crop residue to the soil or regularly adding other organic material improves fertility, increases the available water capacity, and helps to control erosion.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development and onsite waste disposal. The wetness is a limitation on sites for dwellings. Installing drainage tile around the footings and foundations helps to prevent excessive wetness in basements and the damage caused by poor surface drainage. Some land grading may be needed to modify the slope. Septic tank absorption fields can function adequately if a mound of suitable soil material is properly constructed to increase the depth to bedrock. Alternative soils that are better suited to onsite waste disposal generally can be selected.

Low strength, the wetness, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by wetness and frost action.

The land capability classification is IVe. The woodland ordination symbol is 3A.

45D2—Mandeville silt loam, 9 to 14 percent slopes, eroded. This moderately deep, strongly sloping, moderately well drained soil is on side slopes in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the subsurface layer and the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 3 inches thick. The subsoil is about 31 inches thick. It is yellowish brown, friable silty clay loam in the upper part; yellowish brown, firm channery silty clay loam in the next part; and yellowish brown and grayish brown, firm channery silty clay loam in the lower part. Below this to a depth of 60 inches or more is soft shale bedrock. In some areas the surface layer is darker. In other areas the subsoil has more clay.

Included with this soil in mapping are small areas of the deep Greenton, Weller, and Winfield soils. These soils are on side slopes above the Mandeville soil. Greenton soils have a dark surface layer and have more clay than the Mandeville soil. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Mandeville soil. Surface runoff is medium. Natural fertility and the content of organic matter are moderately low. The available water capacity is low. A perched water table commonly is at a depth of about 2 to 3 feet in most winter and spring months. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are wooded. Some areas are used as pasture. Because of the slope and a severe hazard of erosion, this soil is not suited to cultivated crops. It is suited to trees. No major hazards or limitations affect planting or harvesting.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to the commonly grown legumes, such as lespedeza and birdsfoot trefoil; cool-season grasses, such as tall fescue and reed canarygrass; and warm-season grasses, such as big bluestem and Caucasian bluestem. Shallow-rooted, drought-tolerant species grow well. Erosion control is a serious concern during seeding. Timely tillage and a quickly established ground cover help to control erosion.

This soil is suitable for building site development and onsite waste disposal. The depth to bedrock, the wetness, and the slope are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed on the bedrock, and soil material should be shaped around the building or the bedrock should be excavated. Installing drainage tile around the footings and foundations helps to prevent excessive wetness in basements and the damage caused by poor surface drainage. Some land grading may be needed to modify the slope. Septic tank absorption fields can function adequately if a mound of suitable soil material is properly constructed to increase the depth to bedrock. Alternative soils that are better suited to onsite waste disposal generally can be selected.

Low strength, the wetness, frost action, and the slope limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by wetness and frost action. The roads should be designed so that they conform to the natural slope of the land. Some cutting and filling may be needed.

The land capability classification is IVe. The woodland ordination symbol is 3A.

45F—Mandeville silt loam, 14 to 30 percent slopes. This moderately deep, moderately steep and steep, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsurface layer is yellowish brown, friable channery silt loam about 12 inches thick. The subsoil is yellowish brown, friable channery silty clay loam about 9 inches thick. Below this to a depth of 60 inches or more is soft shale bedrock. In some areas flagstones are on the surface. In other areas the depth to shale bedrock is more than 40 inches.

Included with this soil in mapping are small areas of the deep Dockery and Weller soils. Dockery soils are somewhat poorly drained and are on flood plains below the Mandeville soil. Weller soils are moderately well drained and in areas above the Mandeville soil. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Mandeville soil. Surface runoff is rapid. Natural fertility and the content of organic matter are moderately low. The available water capacity is low.

Most areas are wooded. A few small areas on the less sloping parts of the landscape are used as pasture. This soil is not suitable for cultivated crops because of the slope and a severe hazard of erosion.

Stands of native hardwoods are in some areas. This soil is suited to trees. The hazard of erosion, the equipment limitation, and seedling mortality are the main management concerns. Building logging roads and skid trails on the contour minimizes the steepness and length of slopes and the concentration of surface water. Constructing water breaks and seeding disturbed areas after the trees are harvested minimize erosion. Operating equipment on the steep slopes can be hazardous. In the steepest areas the logs should be yarded uphill to logging roads or skid trails. Hand planting or direct seeding may be needed because of the slope. Planting container-grown nursery stock or reinforcement planting increases the seedling survival rate.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to the commonly grown legumes, such as lespedeza and birdsfoot trefoil; cool-season grasses, such as tall fescue and reed canarygrass; and warm-season grasses, such as big bluestem, Caucasian bluestem, and indiangrass. It is moderately suited to most legumes and cool-season grasses. Drought-tolerant, shallow-rooted species grow best. Erosion control is a serious concern during seeding. Timely tillage and a quickly established ground cover help to control erosion.

This soil is suited to the development of habitat for woodland wildlife. The amount of cover is adequate, but forage, especially plants that produce small seeds, is scarce. Timely planting of food plots can improve the habitat. The edge of a wooded tract or another fringe area is a good site for food plots. Also, the plots can be established on the better suited adjacent soils. The habitat should be protected from grazing and fire.

This soil generally is not used for building site development or onsite waste disposal because of the slope.

The land capability classification is VIe. The woodland ordination symbol is 3R.

47B—Monona silt loam, 2 to 5 percent slopes. This deep, gently sloping, well drained soil is on knolls and short side slopes on high terraces. Individual areas are irregular in shape and range from 6 to 300 acres in size.

Typically, the surface layer is very dark brown, very friable silt loam about 12 inches thick. The subsurface layer is very dark grayish brown, very friable silt loam about 11 inches thick. The subsoil to a depth of 60 inches or more is very friable silt loam. It is very dark grayish brown in the upper part and dark yellowish brown in the lower part.

Included with this soil in mapping are small areas of the somewhat poorly drained Joy soils and the poorly drained Winterset soils. Joy soils are in areas below the Monona soil. Winterset soils are in depressions below the Monona soil. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Monona soil. Surface runoff is medium. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is very high. The shrink-swell potential is moderate. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. A few areas are used for pasture or hay. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, soil blowing and water erosion are hazards. Restricting fall plowing reduces these hazards. The measures used to control water erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface and winter cover crops. A combination of terraces and grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes pasture, hay, or wheat also are effective in controlling erosion. A grade stabilization structure may be needed along with the grassed waterways. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to the commonly grown legumes, such as alfalfa and ladino clover; cool-season grasses, such as red fescue and smooth brome; and warm-season grasses, such as big bluestem and switchgrass. No serious hazards or limitations affect pasture or hayland. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover.

This soil is suited to building site development and onsite waste disposal. The shrink-swell potential is a limitation on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to remove excess water. Septic tank absorption fields can function adequately if installed properly. Sewage lagoons can function adequately if the site is leveled and the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent seepage.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

47C2—Monona silt loam, 5 to 9 percent slopes, eroded. This deep, moderately sloping, well drained soil is on convex side slopes on high stream terraces. Erosion has removed 25 to 75 percent of the original surface soil. The remaining surface layer has been mixed with the subsurface layer. Individual areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 10 inches thick. The subsurface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is dark yellowish brown, friable silt loam about 22 inches thick. The substratum to a depth of 60 inches or more is dark yellowish brown, mottled, friable silt loam. In some severely eroded areas, the surface layer is dark brown. In places the upper part of the subsoil is mottled.

Included with this soil in mapping are small areas of the somewhat poorly drained Ackmore and poorly drained Colo soils. These soils are along small streams and are subject to flooding. They make up about 5 percent of the unit.

Permeability is moderate in the Monona soil. Surface runoff is medium. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is very high. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. It tends to crust and puddle, however, after hard rains, especially where the plow layer contains subsoil material.

Most areas are used for cultivated crops (fig. 16). A few areas are used for pasture or hay. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, further erosion is a severe hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface and winter cover crops. A combination of terraces and grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes pasture, hay, or winter wheat also are effective in controlling erosion. A grade stabilization structure may be needed along with the grassed waterways. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to the commonly grown legumes, such as ladino clover; cool-season grasses, such as red fescue and smooth brome; and warm-season grasses, such as big bluestem and switchgrass. No serious hazards or limitations affect pasture or hayland. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover.

This soil is suited to building site development and onsite waste disposal. The moderate shrink-swell potential is a limitation on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to remove excess water. Septic tank absorption fields generally can function adequately if installed properly. Sewage lagoons can function adequately if the site is leveled and the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent seepage.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

50B—McGirk silt loam, 2 to 5 percent slopes. This deep, gently sloping, poorly drained soil is on concave toe slopes and high stream terraces. Individual areas are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is brown, very friable silt loam about 8 inches thick. The subsurface layer is light brownish gray, very friable silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is grayish brown and dark grayish brown, mottled, friable and firm silty clay loam. The next part is dark grayish brown, mottled, very firm silty clay. The lower part is grayish brown, mottled, firm silty clay loam. In some areas the subsoil has less clay.

Included with this soil in mapping are small areas of the moderately well drained Weller soils. These soils are in the higher convex areas. They make up less than 5 percent of the unit.

Permeability is slow in the McGirk soil. Surface runoff is medium. Natural fertility also is medium, and the content of organic matter is moderately low. The available water capacity is high. A perched water table commonly is at a depth of about 0.5 foot to 2.0 feet during most winter and spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and small grain. If cultivated crops are grown, erosion is a hazard and the wetness is a limitation. The measures used to control erosion on this soil include no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface. Winter cover crops, a combination of terraces and grassed waterways, and a conservation cropping system that includes winter wheat, pasture, or hay also are effective in controlling erosion. A grade stabilization structure

Figure 16.—Soybeans in an area of Monona silt loam, 5 to 9 percent slopes, eroded.

may be needed along with the grassed waterways. Diversion of runoff from the uplands, shallow surface drains, and tile drainage reduce the wetness. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to shallow-rooted legumes and grasses. It is moderately suited to the commonly grown legumes, such as ladino clover and alsike clover; moderately well suited to cool-season grasses, such as reed canarygrass; and moderately suited to tall fescue. It is moderately well suited to warm-season grasses, such as switchgrass, and moderately suited to little bluestem and indiangrass. The species that can withstand wetness grow best. Erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to control erosion. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth.

This soil is suited to trees. The equipment limitation, seedling mortality, and the hazard of windthrow are the main management concerns. Because of the wetness, equipment should be used only when the soil is dry or frozen. Ridging the soil and then planting on the ridges increase the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where the hazard of windthrow is slight.

This soil generally is not used for building site development or onsite waste disposal because of the wetness and the slow permeability.

The land capability classification is IIe. The woodland ordination symbol is 3W.

53C—Menfro silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, well drained soil is on the tops of ridges in the uplands. A few sinkholes less than 2 acres in size are in areas of this soil. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is brown, very friable silt loam about 5 inches thick. The subsurface layer is yellowish brown, very friable silt loam about 6 inches thick. The subsoil extends to a depth of 60 inches or more. It is dark yellowish brown, friable silt loam in the upper part and brown, friable silty clay loam in the lower part. In places the subsoil has more clay. In a few areas the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of the somewhat poorly drained Leslie soils. These soils have a dark surface layer and have more clay in the

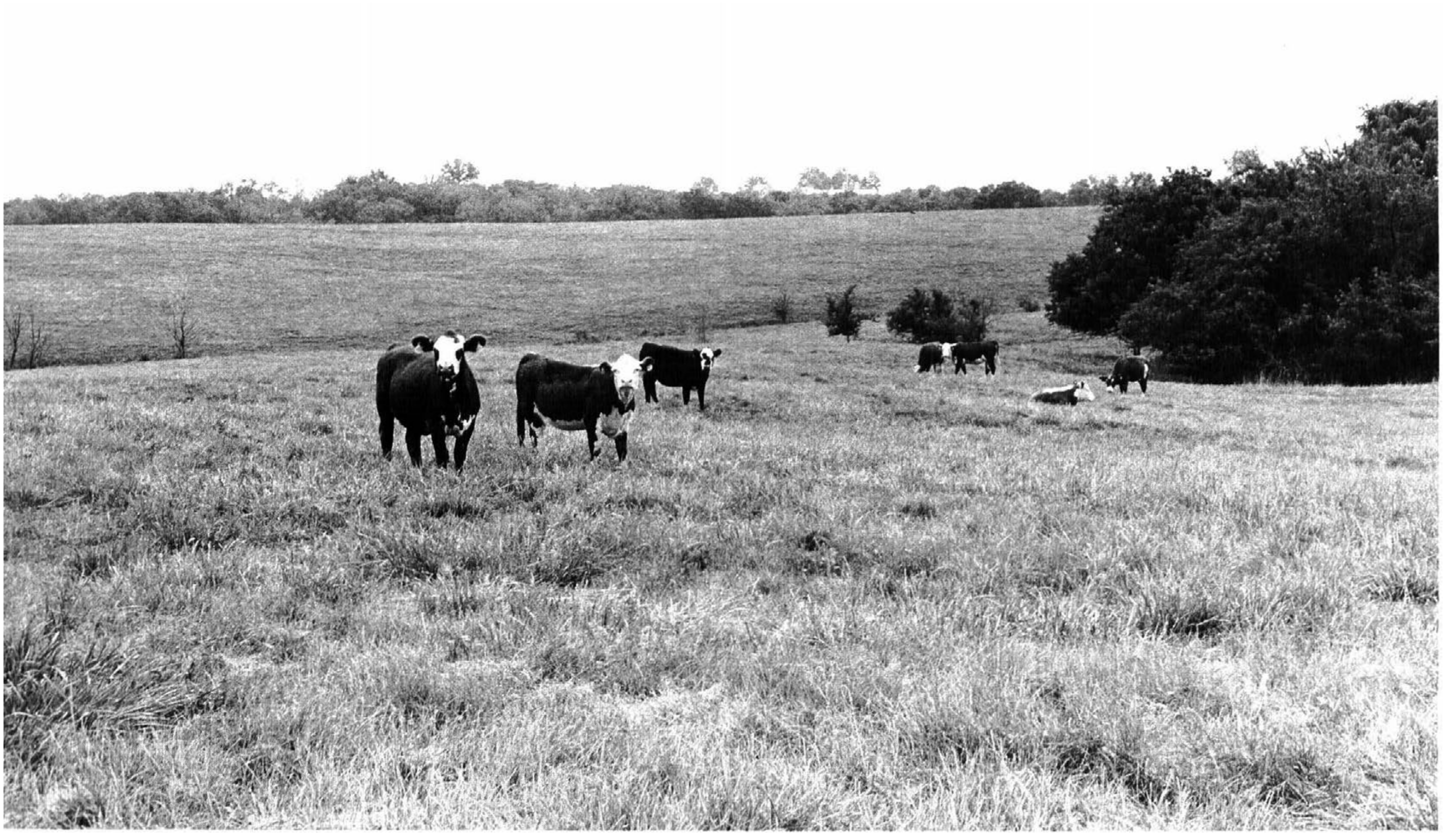

Figure 17.—Beef cattle in a pasture of orchardgrass on Menfro silt loam, 3 to 9 percent slopes.

subsoil than the Menfro soil. They are on the bottom of large sinkholes and in drainageways. They make up less than 5 percent of the unit.

Permeability is moderate in the Menfro soil. Surface runoff is medium. Natural fertility also is medium, and the content of organic matter is moderately low. The available water capacity is high. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled.

Most areas are used for hay or pasture (fig. 17). Some areas are used for cultivated crops. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; cool-season grasses, such as smooth brome and orchardgrass; and warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. No serious management problems affect pasture or hayland. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover.

This soil is suited to cultivated crops, such as corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, erosion is a severe hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, and a combination of terraces, grassed waterways or tile outlets, and a grade stabilization structure. Contour farming and a conservation cropping system that includes pasture, hay, or winter wheat also are effective in controlling erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

Many areas of this soil are suitable for building site development and onsite waste disposal. The areas of sinkholes are not suitable because the sinkholes can collapse and the effluent from onsite waste disposal systems can rapidly contaminate ground water. The shrink-swell potential is a limitation on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to remove excess water. Septic tank absorption fields can function adequately if installed properly. Sewage lagoons can function adequately if the site is leveled and the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent seepage.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Constructing adequate roadside ditches and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

53C2—Menfro silt loam, 3 to 9 percent slopes, eroded. This deep, gently sloping and moderately sloping, well drained soil is on the tops of ridges in the uplands. A few sinkholes less than 2 acres in size are in areas of this soil. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the subsurface layer and the upper part of the subsoil. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil to a depth of 60 inches or more is silty clay loam. It is dark yellowish brown and firm in the upper part and brown and friable in the lower part. In places the subsoil has more clay. In a few areas the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of the somewhat poorly drained Leslie soils. These soils have a dark surface layer and have more clay in the subsoil than the Menfro soil. They are on the bottom of large sinkholes and in drainageways. They make up less than 5 percent of the unit.

Permeability is moderate in the Menfro soil. Surface runoff is medium. Natural fertility also is medium, and the content of organic matter is moderately low. The available water capacity is high. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops (fig. 18), hay, or pasture. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, further erosion is a hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, and a combination of terraces, grassed waterways or tile outlets, and a grade stabilization structure. Contour farming and a conservation cropping system that includes winter wheat and pasture or hay crops also are effective in controlling erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; cool-season grasses, such as smooth brome and orchardgrass; and warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. No serious management problems affect pasture or hayland. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

Many areas of this soil are suited to building site development and onsite waste disposal. The areas of sinkholes are not suitable because the sinkholes can collapse and the effluent from onsite waste disposal systems can rapidly contaminate ground water. The shrink-swell potential is a limitation on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the foundations helps to remove excess water. Septic tank absorption fields can function adequately if installed properly. Sewage lagoons can function adequately if the site is leveled and the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent seepage.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Constructing adequate roadside ditches and installing culverts help to prevent the damage caused by shrinking and swelling.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

53D2—Menfro silt loam, 9 to 14 percent slopes, eroded. This deep, strongly sloping, well drained soil is on convex side slopes. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the subsurface layer and the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is brown silt loam about 5 inches thick. The subsoil is dark yellowish brown, firm

Figure 18.—Soybeans in an area of Menfro silt loam, 3 to 9 percent slopes, eroded.

silty clay loam about 45 inches thick. The substratum to a depth of 60 inches or more is dark yellowish brown, friable silty clay loam. In some areas the lower part of the subsoil has gray mottles. In other areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas of the moderately well drained Weller soils. These soils have more clay than the Menfro soil and have gray mottles throughout the subsoil. They are on concave side slopes. They make up about 5 percent of the unit.

Permeability is moderate in the Menfro soil. Surface runoff is rapid. Natural fertility is medium, and the content of organic matter is moderately low. The available water capacity is high. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled, but it tends to crust after hard rains because it has been mixed with the subsoil.

Most areas are used for hay or pasture or for cultivated crops. A few small areas are wooded.

The use of this soil as hayland or pasture is very effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as red clover and alfalfa; cool-season grasses, such as tall fescue and orchardgrass; and warm-season grasses, such as switchgrass and Caucasian bluestem. Erosion during seedbed preparation and overgrazing are the main management problems. Seedbeds should be prepared on the contour. Timely seedbed preparation helps to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

This soil is suited to corn, grain sorghum, and winter wheat. If cultivated crops are grown, further erosion is a severe hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface. Winter cover crops, a combination of terraces and grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes pasture, hay, or small grain also are effective in controlling erosion. A grade stabilization structure may be needed. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suited to building site development and onsite waste disposal. The slope and the shrink-swell potential are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the foundations helps to remove excess water. Septic tank absorption fields can function adequately if the distribution lines are installed across the slope.

Low strength, the shrink-swell potential, frost action, and the slope limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Constructing adequate roadside ditches and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action. Some cutting and filling may be needed because of the slope.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

53F—Menfro silt loam, 14 to 35 percent slopes. This deep, moderately steep and steep, well drained soil is on dissected side slopes in the uplands. Individual areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsurface layer is yellowish brown, friable silt loam about 6 inches thick. The subsoil is firm silty clay loam about 30 inches thick. The upper part is dark yellowish brown, and the lower part is dark brown. The substratum to a depth of 60 inches or more is dark brown, friable silt loam. In some areas the surface layer is silty clay loam. In other areas the slope is more than 35 percent.

Included with this soil in mapping are small areas of Goss and Lindley soils on the lower side slopes. Goss soils are cherty throughout. Lindley soils are moderately well drained. They have more sand than the Menfro soil and have gray mottles in the subsoil. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Menfro soil. Surface runoff is rapid. Natural fertility is medium, and the content of organic matter is moderately low. The available water capacity is high. The shrink-swell potential is moderate in the subsoil.

Most areas are wooded. A few areas are used for pasture or hay. This soil is not suited to cultivated crops because of the slope and a severe hazard of erosion. It should be tilled only when reseeding of pastures is necessary.

This soil is suited to trees. Because of the slope, erosion is a hazard and operating equipment is hazardous. Building logging roads and skid trails on the contour minimizes the steepness and length of slopes and the concentration of surface water. In some of the steeper areas, the logs should be yarded uphill to the roads and skid trails. Constructing water breaks and seeding disturbed areas after the trees are harvested minimize erosion.

This soil is suited to pasture. It is well suited to most of the commonly grown legumes, such as red clover and alfalfa; cool-season grasses, such as tall fescue and orchardgrass; and warm-season grasses, such as switchgrass and Caucasian bluestem. Erosion during seedbed preparation and overgrazing are the main management problems. Seedbeds should be prepared on the contour. Timely seedbed preparation helps to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are needed.

This soil generally is not used for building site development or onsite waste disposal because of the slope.

The land capability classification is VIe. The woodland ordination symbol is 4R.

57—Joy silt loam. This deep, nearly level, somewhat poorly drained soil is in broad areas on high stream terraces. Individual areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is black, very friable silt loam about 10 inches thick. The subsurface layer is very dark grayish brown, very friable and friable silt loam about 22 inches thick. The subsoil is yellowish brown and grayish brown, friable silt loam about 14 inches thick. The substratum to a depth of about 60 inches is gray, friable silt loam. In places the subsoil contains more clay.

Included with this soil in mapping are small areas of the poorly drained Leslie and Winterset soils. Leslie soils are in depressions below the Joy soil. Winterset soils are in landscape positions similar to those of the Joy soil. Included soils make up about 5 percent of the unit.

Permeability is moderate in the Joy soil. Surface runoff is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is very high. The seasonal high water table commonly is at a depth of about 2 to 4 feet during most winter and spring months. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops (fig. 19). A few areas are used for pasture or hay. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, soil blowing is a

Figure 19.—Corn in an area of Joy silt loam.

hazard and the wetness is a limitation. Restricting fall plowing and applying a conservation tillage system, such as no-till farming, that leaves a protective cover of crop residue on the surface help to control soil blowing. A surface drainage system and field tile can help to remove excess water, but adequate outlets for field tile may not be available. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is well suited to most of the commonly grown legumes, such as ladino clover, red clover, and lespedeza; cool-season grasses, such as orchardgrass, tall fescue, and timothy; and warm-season grasses, such as big bluestem and indiangrass. A seedbed can be easily prepared. A drainage system is beneficial, especially if deep-rooted species are grown.

This soil is suitable for building site development and onsite waste disposal. The wetness is a limitation on sites for dwellings. Installing drainage tile around the footings helps to prevent excessive wetness in basements and the damage caused by wetness. Conventional septic tank absorption fields generally cannot function adequately on this soil because of the wetness. The septic tank system can function adequately, however, if perimeter drains are installed around the absorption field to lower the water table and the site is mounded or otherwise elevated with suitable fill material. Sewage lagoons can function adequately if the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent contamination of the ground water. Alternative soils that are better suited to onsite waste disposal generally can be selected.

Low strength, the wetness, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by wetness and frost action.

The land capability classification is I. No woodland ordination symbol is assigned.

60—Moniteau silt loam. This deep, nearly level, poorly drained soil is on high flood plains. It is occasionally flooded for brief periods. Individual areas are irregular in shape and range from 10 to 75 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is light brownish gray and grayish brown, mottled, friable silt loam about 9 inches thick. The subsoil to a depth of 60 inches or more is mottled, firm silty clay loam. It is dark grayish brown in the upper part and grayish brown and dark grayish brown in the lower part. In a few areas the surface layer is darker. In some places the soil is somewhat poorly drained. In other places it is only rarely flooded.

Included with this soil in mapping are small areas of the somewhat poorly drained Dockery and Vesser soils and the moderately well drained Weller soils. Dockery soils are not characterized by an increase in content of clay with increasing depth. They are on flood plains along small streams. Vesser soils have a dark surface layer. They are in landscape positions similar to those of the Moniteau soil. Weller soils have more clay in the subsoil than the Moniteau soil. They are on side slopes in the uplands. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Moniteau soil. Surface runoff is slow. Natural fertility is medium, and the content of organic matter is moderately low. The available water capacity is high. A perched water table commonly is within a depth of 1 foot in most winter and spring months. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the wetness is a limitation and the flooding is a severe hazard. Land grading, shallow surface drains, and open ditches help to remove excess water. Diversion terraces may be needed to intercept runoff from the uplands. Spring flooding can delay tillage in some years, and areas that are plowed in the fall may be subject to scouring by floodwater. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is well suited to the commonly grown legumes, such as red clover, ladino clover, and lespedeza; cool-season grasses, such as timothy and reed canarygrass; and warm-season grasses, such as switchgrass. The seasonal high water table is the main limitation. The forage species that can withstand wetness grow well. A seedbed can be easily prepared. A drainage system is beneficial, especially if deep-rooted species are grown.

This soil is suited to the trees that can withstand wetness. The equipment limitation, seedling mortality, and the hazard of windthrow are the main management concerns. Equipment should be used only when the soil is dry or frozen. Ridging the soil and then planting on the ridges increase the seedling survival rate. Light, frequent thinning reduces the hazard of windthrow.

This soil is unsuited to building site development and onsite waste disposal because of the flooding and the wetness.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

63—Nodaway silt loam. This deep, nearly level, moderately well drained soil is on flood plains and alluvial fans along tributary streams of the Missouri River. The soil is occasionally flooded in spring and late fall. Individual areas are broad and irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of 60 inches or more also is friable silt loam. It is stratified brown and dark brown in the upper part, stratified dark brown and yellowish brown in the next part, and very dark grayish brown in the lower part. In places the substratum has less clay and fewer free carbonates.

Included with this soil in mapping are small areas of the well drained Knox soils and the somewhat poorly drained Moville soils. Knox soils are characterized by a distinct increase in content of clay between the surface layer and the subsoil. They are on uplands. Moville soils are clayey in the lower part. They are in the lower concave areas. Included soils make up about 2 to 10 percent of the unit.

Permeability is moderate in the Nodaway soil. Surface runoff is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is very high. The seasonal high water table is at a depth of about 3 to 5 feet during most winter and spring months. The shrink-swell potential is moderate. The surface layer can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and small grain. Spring flooding can delay tillage in some years.

This soil is suited to hay and pasture. It is well suited to most of the commonly grown legumes, such as alfalfa and red clover; cool-season grasses, such as tall fescue and orchardgrass; and warm-season grasses, such as big bluestem and switchgrass. The occasional flooding is the main management problem. The species that can withstand wetness grow well. The hazard of flooding should be considered when grazing systems are designed.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is unsuited to building site development and onsite waste disposal because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 3A.

65—Ackmore silt loam. This deep, nearly level, somewhat poorly drained soil is on flood plains along small streams. It is occasionally flooded. Individual areas are long and narrow and range from 10 to 400 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 6 inches thick. The substratum is very friable silt loam about 23 inches thick. It is stratified very dark grayish brown and dark grayish brown in the upper part and stratified very dark gray and grayish brown in the lower part. Below this to a depth of 60 inches or more is a buried soil, which is black, firm silty clay loam. In a few areas the buried soil is at a depth of more than 36 inches.

Included with this soil in mapping are small areas of the poorly drained Colo soils. These soils do not have a buried soil. They are in concave areas. They make up about 5 to 10 percent of the unit.

Permeability is moderate in the Ackmore soil. Surface runoff is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is very high. The seasonal high water table commonly is at a depth of about 1 to 3 feet in most winter and spring months. The shrink-swell potential is high in the lower part of the soil. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops. A few areas are used for hay or pasture. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. Spring flooding can delay tillage, and areas that are plowed in the fall may be subject to scouring by floodwater. Open ditches, shallow surface drains, and land grading help to remove excess water quickly. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is well suited to the commonly grown legumes, such as red clover, ladino clover, and lespedeza; cool-season grasses, such as reed canarygrass; and warm-season grasses, such as switchgrass. The seasonal high water table is the main limitation. It limits the selection of suitable plants. A seedbed can be easily prepared. A drainage system is beneficial, especially if deep-rooted species are grown.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is unsuited to building site development and onsite waste disposal because of the flooding and the wetness.

The land capability classification is IIw. The woodland ordination symbol is 3A.

67C2—Sampsel silty clay loam, 5 to 9 percent slopes, eroded. This deep, moderately sloping, poorly drained soil is on concave side slopes in the uplands. Erosion has removed 25 to 60 percent of the original surface layer. The remaining surface layer has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is very dark gray, firm silty clay loam about 10 inches thick. The subsoil to a depth of 60 inches or more is mottled silty clay. The upper part is dark grayish brown and firm, the next part is grayish brown and very firm, and the lower part is gray, light olive brown, and yellowish brown and is very firm. In places the surface layer is less than 10 inches thick.

Included with this soil in mapping are small areas of the somewhat poorly drained Greenton and Higginsville soils on the higher parts of the landscape. Higginsville soils have less clay in the subsoil than the Sampsel soil. Included soils make up about 5 to 10 percent of the unit.

Permeability is slow in the Sampsel soil. Surface runoff is medium. Natural fertility also is medium, and the content of organic matter is moderate. The available water capacity also is moderate. A perched water table commonly is within a depth of 1.5 feet during most winter and spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a moderate range in moisture content, but it tends to become cloddy after periods of rainfall, especially where the plow layer contains subsoil material.

Most areas are used for cultivated crops. A few areas are used for hay or pasture. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, further erosion is a severe hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface and winter cover crops. A combination of terraces and grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes pasture, hay, or wheat also are effective in controlling erosion. A grade stabilization structure may be needed along with the grassed waterways. 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.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; cool-season grasses, such as tall fescue and reed canarygrass; and warm-season grasses, such as big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover are effective in controlling erosion.

This soil generally is not used for building site development or onsite waste disposal because of the wetness and the high shrink-swell potential.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

68—Winterset silt loam. This deep, nearly level, poorly drained soil is in depressions on high stream terraces. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is black, friable silt loam about 12 inches thick. The subsurface layer also is black, friable silt loam about 12 inches thick. The subsoil to a depth of 60 inches or more is mottled, firm silty clay loam. The upper part is very dark gray and dark gray, and the lower part is grayish brown. In some areas the subsoil has less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Joy and Leslie soils. Joy soils are in the rounder areas. Leslie soils have a thick, leached subsurface layer. They are lower on the landscape than the Winterset soil. Included soils make up about 10 percent of the unit.

Permeability is moderately slow in the Winterset soil. Surface runoff is slow. Natural fertility and the content of organic matter are high. The available water capacity also is high. The seasonal high water table commonly is at a depth of about 1 to 2 feet during most winter and spring months. The shrink-swell potential is high. The surface layer is friable, but it becomes cloddy if tilled when the soil is wet. Also, it crusts or puddles after hard rains.

Most areas are used for cultivated crops. Some areas are used as pasture. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the wetness and the hazard of soil blowing are management problems. Land grading, shallow surface drains, and open ditches help to remove excess water. Restricting fall plowing and leaving a protective cover of crop residue on the surface help to control soil blowing. 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.

This soil is moderately suited to shallow-rooted legumes that can withstand wetness, such as ladino clover and alsike clover, and to cool-season grasses, such as reed canarygrass. It is poorly suited to warm-season grasses. The wetness is the main management concern. Maintaining stands of desirable species is difficult in depressional areas. A surface drainage system is beneficial, especially if deep-rooted species are grown.

This soil generally is not used for building site development or onsite waste disposal because of the wetness and the high shrink-swell potential. Alternative soils that are better suited to these uses generally are available in nearby areas.

The land capability classification is IIw. No woodland ordination symbol is assigned.

70A—Sarpy loamy fine sand, 0 to 4 percent slopes. This deep, nearly level to gently sloping, excessively drained soil is on flood plains along the Missouri River. The soil is subject to rare flooding. Individual areas are long and narrow and range from about 5 to more than 100 acres in size.

Typically, the surface layer is dark brown, loose loamy fine sand about 6 inches thick. The substratum to a depth of 60 inches or more is grayish brown, loose fine sand. In some areas the substratum has more silt and more clay. In other areas the surface layer is fine sand.

Included with this soil in mapping are small areas of Haynie soils. These soils are not so sandy as the Sarpy soil. Also, they are at slightly lower elevations. They make up about 5 percent of the unit.

Permeability is rapid in the Sarpy soil. Surface runoff is slow. Natural fertility and the content of organic matter are low. The available water capacity also is low. The surface layer is loose and can be easily tilled throughout a wide range in moisture content.

Most areas are used for small grain or row crops. Because of the hazard of soil blowing, the low available water capacity, and the low content of organic matter, this soil is poorly suited to cultivated crops. Restricting fall plowing and applying a conservation tillage system, such as no-till farming, that leaves a protective cover of crop residue on the surface help to control soil blowing. Irrigation can improve crop yields. Grain sorghum and alfalfa respond well to irrigation. Frequent applications of irrigation water are needed for the highest yields of small grain or row crops. Because of the rapid permeability, furrow irrigation is impractical. If heavy equipment is used when the soil is irrigated, surface compaction can become a management problem. Returning crop residue to the soil or regularly adding other organic material increases the content of organic matter.

This soil is suited to trees. Seedling mortality is a management concern. Planting container-grown nursery stock or reinforcement planting increases the seedling survival rate.

This soil generally is unsuited to building site development and onsite waste disposal because of the flooding.

The land capability class is IVs. The woodland ordination symbol is 3S.

73B—Sibley silt loam, 2 to 5 percent slopes. This deep, gently sloping, well drained soil is on the convex tops of ridges in the uplands. Individual areas are long and moderately wide and range from 5 to 200 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer also is very dark grayish brown, friable silt loam. It is about 10 inches thick. The subsoil extends to a depth of 60 inches or more. It is dark brown, friable silty clay loam in the upper part; dark yellowish brown, mottled, firm silty clay loam in the next part; and yellowish brown, mottled, friable silt loam in the lower part. In places the dark surface soil is less than 24 inches thick. In a few areas grayish brown mottles are within a depth of 36 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Arispe, Higginsville, and Macksburg soils. Arispe and Higginsville soils are on side slopes below the Sibley soil, and Higginsville and Macksburg soils are in the more nearly level areas on the ridgetops. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Sibley soil. Surface runoff is medium. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is high. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled throughout a moderately wide range in moisture content. It tends to crust or puddle, however, after hard rains.

Most areas are used for cultivated crops (fig. 20). A few areas are used for hay or pasture. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, erosion is a hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface and winter cover crops. A combination of terraces and grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes pasture, hay, or winter wheat also are effective in controlling erosion. A grade stabilization structure may be needed along with the grassed waterways. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; cool-season grasses, such as smooth brome and orchardgrass; and warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. No serious hazards or limitations affect pasture or hayland. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover.

This soil is suited to building site development and onsite waste disposal. The shrink-swell potential is a limitation on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to remove excess water. The soil is suitable as a site for properly installed septic tank absorption fields. Sewage lagoons can function adequately if the site is leveled and the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent seepage.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

73C2—Sibley silt loam, 5 to 9 percent slopes, eroded. This deep, moderately sloping, well drained soil is on convex side slopes in the uplands. Erosion has removed 25 to 75 percent of the original surface soil. The remaining surface layer has been mixed with the subsurface layer. Individual areas are irregular in shape and range from 5 to 200 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 9 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 7 inches thick. The subsoil is silty clay

Figure 20.—Soybeans and corn in an area of Sibley silt loam, 2 to 5 percent slopes.

loam about 36 inches thick. It is dark brown and friable in the upper part and dark yellowish brown and firm in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam. In places the dark surface soil is less than 10 inches thick and has been mixed by tillage with the upper part of the subsoil. In a few areas grayish brown mottles are within 36 inches of the surface.

Included with this soil in mapping are small areas of the somewhat poorly drained Higginsville soils. These soils are on slightly concave side slopes. They make up about 1 to 5 percent of the unit.

Permeability is moderate in the Sibley soil. Surface runoff is medium. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is high. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after hard rains, especially where the plow layer contains subsoil material.

Most areas are used for cultivated crops. A few areas are used for hay or pasture. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, further erosion is a hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface (fig. 21) and winter cover crops. A combination of terraces and grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes pasture, hay, or wheat also are effective in controlling erosion. A grade stabilization structure may be needed along with the grassed waterways. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; cool-season grasses, such as smooth brome and orchardgrass; and warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. No major hazards or limitations affect pasture or hayland. Erosion is a hazard in newly seeded areas. Timely seedbed preparation ensures a good ground cover.

This soil is suited to building site development and onsite waste disposal. The shrink-swell potential is a

Figure 21.—No-till corn in an area of Sibley silt loam, 5 to 9 percent slopes, eroded.

limitation on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Some land grading generally is needed to modify the slope. The soil is suitable as a site for properly installed septic tank absorption fields. Sewage lagoons can function adequately if the site is leveled and if the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent seepage.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

73D2—Sibley silt loam, 9 to 14 percent slopes, eroded. This deep, strongly sloping, well drained soil is on convex side slopes in the uplands. Erosion has removed 25 to 75 percent of the original surface soil. The remaining surface layer has been mixed with the subsurface layer and the upper part of the subsoil. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 5 inches thick. The subsoil is friable silty clay loam about 35 inches thick. It is dark brown in the upper part and dark yellowish brown in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam. In places the dark surface layer has been mixed with the upper part of the subsoil and thus is silty clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Ackmore and Higginsville soils. Ackmore soils have a dark surface layer that is thinner than that of the Sibley soil. They are on narrow flood plains. Higginsville soils are on slightly concave side slopes. Included soils make up about 5 percent of the unit.

Permeability is moderate in the Sibley soil. Surface runoff is medium or rapid. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is high. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. A few areas are used for hay or pasture. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, further erosion is a hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, and a combination of terraces and grassed waterways or tile outlets. Contour farming and a conservation cropping system that includes pasture, hay, or winter wheat also are effective in controlling erosion. A grade stabilization structure may be needed along with the grassed waterways. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; cool-season grasses, such as tall fescue and timothy; and warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management problems. Seedbeds should be prepared on the contour. Timely seedbed preparation helps to ensure rapid plant growth and thus a good ground cover.

This soil is suited to building site development and onsite waste disposal. The shrink-swell potential and the slope are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Some land grading generally is needed to modify the slope. Septic tank absorption fields can be installed on this soil, but the slope is a limitation. Grading the site and designing the lateral fields so that they can function in strongly sloping areas help to overcome the slope. The soil generally is not used as a site for sewage lagoons because of the slope. Alternative soils that are better suited to onsite waste disposal generally can be selected.

Low strength, the shrink-swell potential, frost action, and the slope limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action. Some cutting and filling may be needed to modify the slope.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

76D2—Snead silty clay loam, 9 to 14 percent slopes, eroded. This moderately deep, strongly sloping, moderately well drained soil is on convex side slopes along drainageways. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the upper part of the subsoil. Individual areas are long and narrow and range from 5 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 9 inches thick. The subsoil is mottled, firm and very firm silty clay about 23 inches thick. The upper part is grayish brown, the next part is grayish brown and light olive gray, and the lower part is gray and olive gray. The substratum is gray and olive gray, mottled, very firm silty clay about 3 inches thick. Below this to a depth of 60 inches is soft, weathered shale bedrock.

Included with this soil in mapping are small areas of the somewhat poorly drained Greenton soils. These soils are on side slopes below the Snead soil. They make up about 10 percent of the unit.

Permeability is slow in the Snead soil. Surface runoff is rapid. Natural fertility is high, and the content of organic matter is moderate. The available water capacity also is moderate. The seasonal high water table commonly is at a depth of about 2 to 3 feet during most winter and spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable but becomes cloddy if tilled when the moisture content is too high.

Most areas are used for pasture or hay. Some small areas are cultivated along with the surrounding soils. A few areas are wooded. Because of a severe hazard of erosion, this soil is not suited to cultivated crops. It should be used for small grain only on small acreages.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is moderately well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; cool-season grasses, such as tall fescue and timothy; and warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Erosion is a severe hazard. A good ground cover is needed at all times if production is to be maintained. Nurse crops help to control erosion in newly seeded areas. Timely tillage is needed. Tilling on the contour and using no-till seeding methods are effective in controlling erosion.

A few areas support native hardwoods. This soil is suited to trees. Seedling mortality and the hazard of windthrow are the main management concerns. Planting container-grown nursery stock or reinforcement planting increases the seedling survival rate. Light, frequent thinning reduces the hazard of windthrow.

This soil generally is not used for building site development or onsite waste disposal because of the slope, the high shrink-swell potential, and the wetness.

The capability subclass is VIe. The woodland ordination symbol is 3D.

83—Moville silt loam. This deep, nearly level, somewhat poorly drained soil is on flood plains along the Missouri River. The soil is occasionally flooded because of levee breaks or runoff from the adjacent areas. Individual areas are irregular in shape and range from 20 to more than 200 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 7 inches thick. The substratum is stratified dark grayish brown and grayish brown, friable silt loam about 15 inches thick. Below this to a depth of 60 inches or more is a buried soil, which is firm silty clay. The upper part of the buried soil is very dark gray, and the lower part is dark gray and gray and is mottled. In some areas the upper 20 inches of the soil has more sand. In other areas the buried soil is at a depth of more than 30 inches.

Included with this soil in mapping are small areas of Darwin and Haynie soils. Darwin soils are clayey in the upper part. They are in the lower areas. Haynie soils do not have a clayey buried soil in the lower part. They are in the slightly higher areas. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Moville soil and very slow in the lower part. Surface runoff is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity also is moderate. The seasonal high water table commonly is at a depth of about 1 to 3 feet during most winter and spring months. The shrink-swell potential is high in the clayey buried soil. The surface layer is friable and can be easily tilled throughout a moderately wide range in moisture content.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. The wetness is the main limitation. Land grading, shallow surface drains, and open ditches reduce the wetness. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is unsuited to building site development and onsite waste disposal because of the flooding and the wetness.

The land capability classification is IIw. No woodland ordination symbol is assigned.

86—Waldron silty clay. This deep, nearly level, somewhat poorly drained soil is on flood plains along the Missouri River. The soil is protected by levees, but it is occasionally flooded because of levee breaks. Individual areas are long and narrow and range from 5 to more than 50 acres in size.

Typically, the surface layer is very dark gray, firm silty clay about 10 inches thick. The substratum extends to a depth of 60 inches or more. It is stratified very dark gray and dark grayish brown, very firm silty clay in the upper part; stratified dark grayish brown, firm silty clay and grayish brown silt loam in the next part; and stratified dark gray and very dark grayish brown, firm silty clay in the lower part. In places the substratum has less clay. In some areas the soil is poorly drained. In other areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Haynie and Levasy soils. Haynie soils are silty throughout. They are in the higher, rounder areas. Levasy soils are silty clay in the upper part and loamy in the lower part. They are in the lower depressions. Included soils make up about 10 percent of the unit.

Permeability is slow in the Waldron soil. Surface runoff also is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity also is moderate. The seasonal high water table commonly is at a depth of about 1 to 3 feet during most winter and spring months. The shrink-swell potential is high. The surface layer is firm when dry and sticky when wet. It becomes cloddy if tilled when wet or dry.

Most areas are used for cultivated crops. A few small areas are wooded. This soil is suited to corn, soybeans, and small grain. The wetness is the main management problem. Open ditches, shallow surface drains, and land grading are needed to remove excess water. Delayed planting may be needed to minimize the crop damage caused by flooding. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. The equipment limitation and seedling mortality are the main management concerns. Equipment should be used only when the soil is dry or frozen. Planting container-grown nursery stock or reinforcement planting increases the seedling survival rate.

This soil is unsuited to building site development and onsite waste disposal because of the wetness and the flooding.

The land capability classification is IIw. The woodland ordination symbol is 11C.

90B—Weller silt loam, 2 to 5 percent slopes. This deep, gently sloping, moderately well drained soil is on the tops of ridges in the uplands and on high stream terraces. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is grayish brown, friable silt loam about 6 inches thick. The subsoil is about 38 inches thick. It is dark yellowish brown, mottled, firm silty clay loam in the upper part; dark yellowish brown and grayish brown, firm silty clay in the next part; and grayish brown, firm silty clay loam in the lower part. The substratum to a depth of 60 inches or more is grayish brown, firm silty clay loam. In some areas the surface layer is darker. In a few places the subsoil has less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Arispe and Macksburg soils. These soils have a dark surface layer that is more than 10 inches thick. Arispe soils are on the higher side slopes. Macksburg soils are on broad ridgetops. Included soils make up about 5 to 10 percent of the unit.

Permeability is slow in the Weller soil. Surface runoff is medium. Natural fertility also is medium, and the content of organic matter is moderately low. The available water capacity is high. A perched water table commonly is at a depth of about 2 to 4 feet during most winter and spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops. A few areas are used for pasture or hay (fig. 22). This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, erosion is a hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, a combination of terraces and grassed waterways, and a conservation cropping system that includes pasture, hay, or wheat. A grade stabilization structure may be needed along with the grassed waterways. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; cool-season grasses, such as tall fescue and reed canarygrass; and warm-season grasses, such as big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to control erosion.

This soil is suited to trees. Seedling mortality and the hazard of windthrow are the major management concerns. Planting container-grown nursery stock or reinforcement planting increases the seedling survival rate. Light, frequent thinning reduces the hazard of windthrow.

This soil is suitable for building site development and onsite waste disposal. The shrink-swell potential and the wetness are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness in basements and the damage caused by wetness. Because of the wetness and the slow permeability, the soil is unsuitable as a site for conventional septic tank absorption fields. Sewage lagoons can function adequately if the site is leveled. Alternative soils that are better suited to onsite waste disposal generally can be selected.

Low strength, the shrink-swell potential, the wetness, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. The woodland ordination symbol is 3C.

90C2—Weller silt loam, 5 to 9 percent slopes, eroded. This deep, moderately sloping, moderately well drained soil is on side slopes in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the subsurface layer and the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

Figure 22.—Beef cattle grazing in a pasture of orchardgrass in an area of Weller silt loam, 2 to 5 percent slopes.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is mottled, firm silty clay loam about 50 inches thick. It is yellowish brown in the upper part, yellowish brown and grayish brown in the next part, and light brownish gray in the lower part. The substratum to a depth of 60 inches or more is light brownish gray, mottled, firm silty clay loam. In some areas tillage has mixed the surface layer with the upper part of the subsoil. In a few areas the surface layer is darker.

Included with this soil in mapping are small areas of the somewhat poorly drained Arispe soils and the well drained Goss soils. Arispe soils have a dark surface layer that is more than 10 inches thick. They are in landscape positions similar to those of the Weller soil. Goss soils have chert throughout. They are on the steeper side slopes below the Weller soil. Included soils make up about 5 to 10 percent of the unit.

Permeability is slow in the Weller soil. Surface runoff is medium. Natural fertility also is medium, and the content of organic matter is moderately low. The available water capacity is high. A perched high water table commonly is at a depth of about 2 to 4 feet during most winter and spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled.

Most areas are used for pasture or hay or for cultivated crops. A few small areas are wooded (fig. 23). This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; cool-season grasses, such as tall fescue and reed canarygrass; and warm-season grasses, such as big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to control erosion.

This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, erosion is a hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, and a combination of terraces and grassed waterways or tile outlets. Contour farming and a conservation cropping system that includes pasture, hay, or winter wheat also are effective in controlling erosion. A grade stabilization structure may be needed along with the grassed waterways. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. Seedling mortality and the hazard of windthrow are the main management problems. Planting container-grown nursery stock or reinforcement planting increases the seedling survival rate. Light, frequent thinning reduces the hazard of windthrow.

This soil is suitable for building site development and onsite waste disposal. The shrink-swell potential and the wetness are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness in basements and the damage caused by wetness. Some land grading generally is needed to modify the slope. Because of the wetness and the slow permeability, the soil is unsuitable

Figure 23.—Hardwood forest in an area of Weller silt loam, 5 to 9 percent slopes, eroded.

as a site for conventional septic tank absorption fields. Sewage lagoons can function adequately if the site is leveled. Alternative soils that are better suited to onsite waste disposal generally can be selected.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3C.

90D2—Weller silt loam, 9 to 14 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on side slopes in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the subsurface layer and the upper part of the subsoil. Individual areas are long and narrow and range from 5 to more than 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is yellowish brown, mottled, firm silty clay loam. The next part is grayish brown, mottled, firm silty clay and silty clay loam. The lower part is grayish brown, mottled, very firm silty clay loam. In places glacial sand and gravel and shale chips are in the lower part of the subsoil. In some areas the subsoil has less clay.

Included with this soil in mapping are small areas of the well drained Bluelick soils and small areas of severely eroded soils. Bluelick soils are at the lower elevations. Included soils make up about 5 percent of the unit.

Permeability is slow in the Weller soil. Surface runoff is medium. Natural fertility also is medium, and the content of organic matter is moderately low. The available water capacity is high. A perched water table commonly is at a depth of about 2 to 4 feet during most winter and spring months. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled.

Most areas are used as pasture or hayland. The rest are used as cropland or woodland. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; cool-season grasses, such as tall fescue and reed canarygrass; and warm-season grasses, such as big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Erosion is the main management problem. A good ground cover is needed at all times if production is to be maintained. Nurse crops help to prevent excessive soil loss in newly seeded areas. Timely tillage is needed. Tilling on the contour helps to control erosion. Overgrazing should be avoided.

This soil is suited to cultivated crops grown on small acreages. If cultivated crops are grown, erosion is a severe hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, and grassed waterways. Contour farming and a conservation cropping system that includes close-growing pasture or hay crops also are effective in controlling erosion. A grade stabilization structure generally is needed in grassed waterways. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. Seedling mortality and the hazard of windthrow are the major management concerns. Planting container-grown nursery stock or reinforcement planting increases the seedling survival rate. Light, frequent thinning reduces the hazard of windthrow.

This soil is suitable to building site development and onsite waste disposal. The shrink-swell potential, the wetness, and the slope are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness in basements and the damage caused by wetness. Some land grading generally is needed to modify the slope. Because of the wetness and the slow permeability, the soil is unsuitable as a site for conventional septic tank absorption fields. Sewage lagoons can function adequately if the site is leveled. Alternative soils that are better suited to onsite waste disposal generally can be selected.

Low strength, the shrink-swell potential, the wetness, frost action, and the slope limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action. Some cutting and filling may be needed because of the slope.

The land capability classification is IVe. The woodland ordination symbol is 3C.

93C2—Winfield silt loam, 3 to 9 percent slopes, eroded. This deep, gently sloping and moderately sloping, moderately well drained soil is on the tops of ridges in the uplands and on high stream terraces. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer has been mixed with the subsurface layer and the upper part of the subsoil. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is yellowish brown silty clay loam about 37 inches thick. It is friable and firm in the upper part and mottled and firm in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, mottled, firm silty clay loam. In places the surface layer is silty clay loam. In a few areas it is dark brown.

Included with this soil in mapping are small areas of Lindley soils. These soils are steep and are on the lower parts of side slopes. They have glacial sand and gravel. They make up about 5 to 10 percent of the unit.

Permeability is moderate in the Winfield soil. Surface runoff is medium. Natural fertility also is medium, and the content of organic matter is moderately low. The available water capacity is high. A perched water table commonly is at a depth of about 2.5 to 4.0 feet during most winter and spring months. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops (fig. 24). A few areas are used as pasture or hayland. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, erosion is a hazard. The measures used to control erosion on this soil are no-till farming or another conservation tillage system that leaves a protective cover of crop residue on the surface, winter cover crops, and a combination of terraces and grassed waterways or tile outlets. Contour farming and a conservation cropping system that includes pasture, hay, or small grain also are effective in controlling erosion. A grade stabilization structure may be needed along with the grassed waterways. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; cool-season grasses, such as smooth brome and orchardgrass; and warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. Erosion during seedbed preparation is the main management problem. Timely tillage and a quickly established ground cover help to control erosion.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development and onsite waste disposal. The shrink-swell potential and the wetness are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent the damage caused by wetness. Some land grading generally is needed to modify the slope. Conventional septic tank absorption fields generally do not function adequately on this soil because of the wetness. The septic tank system can function adequately, however, if perimeter drains are installed around the absorption field to lower the water table and the site is mounded or otherwise elevated with suitable fill material. Sewage lagoons can function adequately if the site is leveled and the berms and bottom of the lagoons are sealed with slowly permeable material, which helps to prevent contamination of the ground water. Alternative soils that are better suited to onsite waste disposal generally can be selected.

Low strength, the shrink-swell potential, the wetness, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock or other suitable material should be added to strengthen the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

95—Wiota silt loam. This deep, nearly level, well drained soil is on high flood plains. It is subject to rare flooding of brief duration. Individual areas are long and narrow and range from 5 to 50 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 10 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 10 inches thick. The subsoil is silty clay loam about 28 inches thick. The upper part is dark brown and friable, and the lower part is dark yellowish brown and firm. The substratum to a depth of 60 inches or more is dark yellowish brown, friable silt loam. In places the subsoil has less clay. In some areas the soil is occasionally flooded.

Included with this soil in mapping are small areas of the poorly drained Bremer and somewhat poorly drained Vesser soils. These soils are in the more

Figure 24.—Corn in an area of Winfield silt loam, 3 to 9 percent slopes, eroded.

concave areas. They contain more clay in the subsoil than the Wiota soil. Also, Vesser soils have a light colored, leached subsurface layer. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Wiota soil. Surface runoff is medium. Natural fertility is high, and the content of organic matter is moderate. The available water capacity is high. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled throughout a moderately wide range in moisture content. It tends to crust or puddle, however, after hard rains.

Most areas are used for cultivated crops (fig. 25). A few areas are used for hay or pasture. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. No major hazards or limitations affect cultivation. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to grasses and legumes for pasture and hay. It is well suited to most of the commonly grown legumes, such as alfalfa and red clover; cool-season grasses, such as smooth brome and orchardgrass; and warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. No major hazards or limitations affect pasture or hayland.

This soil generally is not used for building site development or onsite waste disposal because of the flooding.

The land capability classification is I. No woodland ordination symbol is assigned.

96—Zook silty clay. This deep, nearly level, poorly drained soil is on flood plains along the larger streams. It is frequently flooded. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is black, firm silty clay about 8 inches thick. The subsurface layer also is black, firm silty clay. It is about 18 inches thick. The subsoil to a depth of 60 inches or more is mottled, firm and very firm silty clay. It is very dark gray in the upper part and dark gray in the lower part. In places the surface layer is silty clay loam. Some areas have overwash of silt loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Dockery and Vesser soils. Dockery soils are adjacent to stream channels and are stratified. Vesser soils are in the higher areas. They have a light colored, leached subsurface layer. Included soils make up about 10 percent of the unit.

Permeability is slow in the Zook soil. Surface runoff also is slow. Natural fertility is high, and the content of organic matter is moderate. The available water capacity also is moderate. The seasonal high water table commonly is within a depth of about 3 feet during most winter and spring months. The shrink-swell potential is high. The surface layer is sticky when wet and can be easily tilled only under optimum moisture conditions. It becomes cloddy if tilled when wet.

Most areas are used as pasture. Some areas are used for row crops. This soil is moderately suited to the commonly grown legumes, such as ladino clover and alsike clover, and to cool-season grasses, such as reed canarygrass. It is poorly suited to warm-season grasses and to hay. The wetness and the flooding are the main management problems. The hazard of flooding should be considered when grazing systems are designed. Maintaining stands of desirable species is difficult in depressions. A surface drainage system is beneficial, especially if deep-rooted species are grown.

Some areas of this soil are used for annual, short-season grain crops. Because of the wetness and the flooding, crops planted in depressions may drown out. Land grading, shallow surface ditches, and open ditches help to remove excess water. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is unsuited to building site development and onsite waste disposal because of the flooding and the wetness.

The land capability classification is Vw. No woodland ordination symbol is assigned.

Figure 25.—Soybeans in an area of Wiota silt loam.

99F—Lindley silt loam, 14 to 35 percent slopes. This deep, moderately steep and steep, moderately well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is light yellowish brown, friable silt loam about 5 inches thick. The subsoil is clay loam about 26 inches thick. The upper part is yellowish brown and firm; the next part is yellowish brown, mottled, and very firm; and the lower part is light brownish gray, mottled, and very firm. The substratum to a depth of 60 inches or more is light brownish gray, mottled, firm clay loam. In places the surface layer is loam. In some areas the substratum is stratified clay loam, loamy fine sand, and sandy clay.

Included with this soil in mapping are small areas of Plainfield and Winfield soils. Plainfield soils have much more sand than the Lindley soil. They are in the steeper areas adjacent to stream channels. Winfield soils do not have glacial sand and gravel. They are in narrow, moderately sloping, convex areas. Included soils make up about 10 percent of the unit.

Permeability is moderately slow in the Lindley soil. Surface runoff is rapid. Natural fertility is medium, and the content of organic matter is moderately low. The available water capacity is high. A perched water table commonly is at a depth of about 2.0 to 3.5 feet during most winter and spring months. The shrink-swell potential is moderate in the subsoil.

Most areas are wooded. A few small areas are used as pasture. This soil is unsuitable for cultivated crops because of the slope and a severe hazard of erosion.

Stands of native hardwoods are in some areas. This soil is suited to trees. The hazard of erosion and the equipment limitation are the main management concerns. Building logging roads and skid trails on the contour minimizes the steepness and length of slopes and the concentration of surface water. In the steepest areas the logs should be yarded uphill to the roads and skid trails. In these areas hand planting of seedlings may be needed. Constructing water breaks and seeding disturbed areas after the trees are harvested minimize erosion.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; cool-season grasses, such as tall fescue and timothy; and warm-season grasses, such as Caucasian bluestem, big bluestem, and switchgrass. It generally is not used as hayland because of the slope. Erosion is the main management problem. A good ground cover is needed at all times to maintain production. Nurse crops help to control erosion in newly seeded areas. Timely tillage is needed. Tilling on the contour and using no-till seeding methods are effective in controlling erosion. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

This soil is suited to habitat for woodland wildlife. The amount of cover for wildlife is adequate, but forage, especially legumes and seeds, are scarce. Timely planting of food plots on the less sloping included soils improves the habitat. The edge of a wooded tract or another fringe area is a good site for food plots. Also, the plots can be established on the better suited adjacent soils. The habitat should be protected from grazing and fire.

This soil generally is not used for building site development or onsite waste disposal because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

100—Pits, quarries. This unit consists of areas on uplands that have been used for limestone quarrying. These areas generally consist of quarry pits, stockpiles of lime and crushed rock, overburden spoil, equipment areas, and transport roads. A few small areas are borrow pits or strip mines. Individual areas range from 5 to more than 100 acres in size.

Some areas of soils included in this unit support trees, annual weeds, or perennial grasses.

The active quarry pits are dry, but most abandoned pits contain water (fig. 26). Most of the abandoned pits are suited to certain recreational uses and to the development of wildlife habitat. Reclaimed areas around and between the pits are suitable for grazing. Onsite investigation is needed to determine the suitability of specific areas for any proposed use.

This unit is not assigned to a land capability classification or a woodland ordination symbol.

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 or built-up land or water areas. It either is

Figure 26.—An abandoned quarry in an area of Pits, quarries.

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 to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure 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 177,000 acres in the survey area meets the requirements for prime farmland. An additional 29,788 acres meets the requirements only in areas where the soil is drained. More than 135,000 acres of the prime farmland is on high terraces and upland ridgetops that have slopes of 0 to 5 percent. The rest consists of alluvial soils on flood plains along the Missouri and Blackwater Rivers and their tributaries. Most of the prime farmland is used for cultivated crops, mainly corn and soybeans.

A recent trend in land use in some parts of the survey area 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."

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify for prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. 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 behavioral 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 recreational 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

Wayne McReynold, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, 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.

More than 300,000 acres in Saline County was used as cropland or hayland in 1985. Of this total, 121,700 acres was used for corn or grain sorghum; 114,000 acres for soybeans; 30,000 for close-grown crops, mainly winter wheat; and 29,000 acres for hay *(9)*. The rest was used as permanent pasture or for conservation purposes or was idle cropland. Since 1967, a small acreage of cropland has been converted to highway construction and urban development. Because of fluctuations in the number of livestock in the 1970's, the acreage used for row crops has increased and the acreage used as permanent pasture has decreased.

The potential for the sustained production of crops on the soils in the survey area is good. About 177,000 acres in the survey area, or 36 percent of the total acreage, is prime farmland. Adequate conservation practices were applied on only about 25 percent of the cropland and 30 percent of the pasture in 1982 *(16)*. Cropland makes up most of the inadequately protected farmland. The current farming practices on this unprotected cropland cause erosion in excess of that considered tolerable if crop production is to be sustained over a long period.

Some of the marginal cropland used for row crops in the survey area should be converted to pasture or hayland. On most of this marginal cropland, applying a system of conservation practices designed for specific sites can hold erosion within tolerable limits.

Erosion is a major management concern on nearly all of the sloping cropland and overgrazed pasture in the survey area. It is a hazard in areas where the soils have slopes of more than 2 percent.

Loss of the surface layer through erosion reduces the productivity of the soils and causes the sedimentation of streams. Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Arispe, Greenton, McGirk, Sampsel, and Weller soils. Erosion also reduces the productivity of Moko, Mandeville, Snead, and other soils that tend to be droughty because of a low available water capacity. Erosion on farmland results in the sedimentation of streams, lakes, and ponds. Measures that control erosion minimize this pollution and improve water quality for municipal and recreational uses and for fish and wildlife. They also prolong the usefulness of the ponds and lakes.

Measures that control erosion provide a protective plant cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a protective cover of plants or crop residue on the surface can hold soil losses to an amount that does not reduce the productive capacity of the soil. Growing grasses and legumes for pasture and hay is effective in controlling erosion. Also, including legumes, such as clover and alfalfa, in the crop rotation improves tilth and provides nitrogen for the following crop.

Terraces reduce the length of slopes and thus help to control runoff and erosion. Conventional terraces are practical on the upland soils that have long, smooth slopes of less than 8 percent. In the more strongly sloping areas of Knox and Menfro soils, however, special construction and management practices are needed if the terraces are to be effective. Soil losses are severe if row crops are grown in moderately steep areas of the Knox soils. Terraces that have grassed back slopes reduce the gradient of the slopes. Conventional terraces, however, increase the gradient. As a result, further erosion-control measures are needed.

Although terraces can be effective on many of the soils in the survey area, they are less successful on eroded soils that have a high content of clay in the surface layer. In some areas of Arispe, Greenton, McGirk, Sampsel, and Weller soils, special management is needed if terracing has exposed the clayey subsoil.

Where farmers do not choose to construct terraces or where the soil is not suited to terraces, other conservation practices are effective in controlling erosion. Contour stripcropping helps to control erosion through the use of contour strips of permanent vegetation. These strips of grasses or of grasses and legumes are generally used for hay, and the areas between the strips are used for row crops, which are planted on the contour. No-till farming is becoming more common in the survey area. It is effective in controlling erosion on sloping soils. It is suitable on many of the soils in the survey area, but special management is needed on severely eroded soils.

On strongly sloping soils a cropping system that provides a substantial plant cover is needed to control erosion unless a conservation tillage system can be applied. A large amount of crop residue should be left on the surface. On sloping soils minimizing tillage and leaving a large amount of crop residue on the surface increase the rate of water infiltration and help to control runoff and erosion.

Soil blowing is a hazard in unprotected areas of Joy, Haynie, Monona, and Sarpy soils. It can be controlled by spring plowing, winter cover crops, and field windbreaks.

Soil drainage is a management concern on about 50 percent of the cropland and pasture in the survey area. Soils on uplands, such as Arispe, Greenton, Higginsville, and Sampsel soils, have good surface drainage, but their internal drainage is poor or somewhat poor because of moderately slow or slow permeability throughout the profile or because of underlying material that is less permeable than is needed for proper drainage. These soils stay cold longer in spring than better drained soils. In some areas they have hillside seeps. Drainage tile may be needed in these areas. Early spring tillage helps to dry out and warm up the surface.

Soils on flood plains, such as Bremer, Colo, and Zook soils, are naturally wet because of their positions along small streams, slow permeability, or both. In addition, these soils receive surface water from the adjoining uplands. Diversion terraces can be used to intercept the water from the uplands, and shallow surface drains and land shaping can help to remove the surface water. Drainage tile can be installed in the Colo soils. The somewhat poorly drained Leta and Moville soils are on flood plains along the Missouri River. Field ditches and land shaping generally improve the drainage of these soils.

Flooding is a management concern on about 20 percent of the cropland and pasture in the survey area. Darwin and Sarpy soils are on flood plains along the Missouri River and are subject to rare flooding. Leta, Waldron, and Moville soils are on flood plains along the Missouri River and are occasionally flooded because of levee breaks. The most damaging flooding occurs in May or June.

Ackmore, Bremer, Colo, Dameron, Moniteau, and Zook soils are on flood plains along the smaller streams. Most of these soils are not protected by levees. Dockery soils are on flood plains along the

Blackwater River and the smaller streams and are frequently flooded. Flooding along the smaller streams generally occurs during the period November through May, but it can occur at any time of the year or several times a year. Flooding along the smaller streams is of shorter duration than flooding along the Missouri River. Major flood-control measures are not economically feasible along the smaller streams.

Streambank erosion is a hazard along the smaller streams. It can be controlled by tree planting, tree revetments, and other measures *(17)*. The Missouri Conservation Commission and the Soil Conservation Service can help to determine the extent of the hazard and offer alternatives that can reduce the hazard.

Soil fertility is naturally lower in most of the eroded and shallow soils in the survey area. All soils, however, require additional plant nutrients for maximum production. Most of the soils are naturally acid in the upper part of the root zone and require applications of ground limestone to raise the pH and calcium levels sufficiently for the optimum growth of legumes. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on needs of the crop, and on the desired level of yields. The Cooperative Extension Service can help to determine the kinds and amounts of fertilizer and lime needed.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous. The tilth of each soil in the survey area is described in the section "Detailed Soil Map Units."

Most of the uneroded upland soils that are used for crops have a surface layer of dark silt loam that is moderate or high in content of organic matter. Tillage and compaction generally result in weaker structure in these soils. During periods of heavy rainfall, a crust forms on the surface. The crust is hard when dry. It reduces the rate of water infiltration and increases the runoff rate. Regularly adding crop residue, manure, or other organic material improves soil structure and tilth.

In all areas of eroded soils on uplands, the surface layer has more clay than the surface layer in corresponding uneroded soils, tilth is poorer, the rate of water infiltration is slower, and runoff is more rapid. Measures that control further erosion and improve tilth are needed on the eroded soils.

Fall plowing is not recommended on most of the soils in the uplands. Most areas of cropland are made up of sloping soils that are subject to erosion if they are plowed in the fall. Plowing the clayey, nearly level Aholt, Darwin, and Levasy soils in the fall, however, generally results in better tilth and does not result in excessive erosion. These soils commonly stay wet until late in spring. If they are plowed when wet, they tend to become cloddy when dry. Because of the cloddiness, preparing a seedbed is difficult.

The central-pivot and rain-gun irrigation systems currently are used in the survey area. These systems supply supplemental water during critical periods of crop growth and thus increase yields. Double-cropping is possible on irrigated soils. Soybeans, for example, can be planted directly into wheat stubble if an irrigation system supplies enough moisture to ensure germination and plant growth.

The need for soil and water conservation practices should be considered in estimating the costs and benefits of an irrigation system. Immediately after irrigation, the saturated topsoil is extremely susceptible to erosion, which can drastically reduce natural fertility and cause rapid sedimentation in downstream bodies of water.

Careful maintenance of terraces also is a management concern in irrigated areas. Allowing ruts to develop where the irrigation equipment wheels pass over the saturated terrace berm can reduce the effectiveness of the terrace.

The pasture and hay crops suited to the soils and climate of the survey area include several legumes, cool-season grasses, and warm-season native grasses. Alfalfa and red clover are the most common legumes grown for hay. They also are grown with bromegrass, orchardgrass, or timothy for hay and pasture.

The warm-season native grasses suited to the soils and climate of the survey area include big bluestem, little bluestem, Caucasian bluestem, indiangrass, and switchgrass. These grasses provide forage during the hot summer months. They should be planted in April or May. After establishment, the fields where they have been growing should be burned once every 3 to 5 years. Burning helps to stimulate seed production, helps to prevent the excessive accumulation of plant residue, and controls undesirable vegetation.

Deep, moderately well drained or well drained soils, such as Haynie, Knox, Ladoga, Menfro, Sibley, and Winfield soils, are better suited to alfalfa and other commonly grown legumes and grasses than the other soils in the survey area. Somewhat poorly drained soils, such as Arispe, Greenton, Higginsville, and Macksburg soils, are better suited to ladino clover, lespedeza, tall fescue, reed canarygrass, and switchgrass than to other forage species. Plants that can withstand wetness grow well on Bremer, Colo, Sampsel, and Zook soils.

The major management concerns in most of the pastured areas are overgrazing and gully erosion. Grazing should be controlled so that the plants can survive and achieve the maximum production. Keeping grasses at a desirable height helps to control runoff and gully erosion.

A small acreage in the survey area is planted to orchards or specialty crops, such as asparagus, dill, and potatoes. These crops generally require special equipment, management, and propagation techniques.

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 also are 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 rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(14)*. 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 or hazards that restrict their use.

Class II soils have moderate limitations or hazards that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations or hazards that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations or hazards 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 or hazards that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations or hazards that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations or hazards that nearly preclude their use for commercial crop production. There are no class VIII soils in the survey area.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w,* or *s,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the 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); and *s* shows that the soil is limited mainly because it is shallow, droughty, or stony.

In class I there are no subclasses because the soils of this class have few limitations. Class V generally contains only the subclasses indicated by *w* or *s* 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

James L. Robinson, forester, Soil Conservation Service, helped prepare this section.

Approximately 10 percent of the land area in the survey area is forested *(16)*.

Information about soils helps to provide a basic understanding of how forest types develop and tree growth occurs. Some of these relationships have been recognized for a long time. White oak grows well on deep, moist soils. Hickories, post oak, and chinkapin oak are more prevalent where the rooting depth or moisture supply is limited. The soil serves as a reservoir for moisture, provides an anchor for roots, and supplies most of the available plant nutrients. The soil properties that directly or indirectly affect these growth requirements include reaction, fertility, drainage, texture, structure, and depth. Landscape position also is important.

Available water capacity is influenced mainly by texture, rooting depth, and content of coarse fragments, such as shale and chert. For example, available water capacity is high in the deep Knox silt loam in the Knox-Menfro-Sibley association. In contrast, the depth to bedrock limits the available water capacity and root development in Mandeville soils. Little can be done to change these limitations, which reduce the productive potential of the Mandeville soils. Under good management, however, tree species adapted to these conditions can be grown on these soils.

Tree growth depends on the nutrient supply in the layers of the soil. The subsoil in many of the soils on uplands has been leached and thus has few nutrients. The substratum of most soils on bottom land has a larger amount of nutrients.

The layer of leaf litter on the surface is as important to tree growth as the mineral layers of the soil. Decomposition of this organic layer recycles the nutrients that have accumulated in the forest ecosystem over long periods. These nutrients thus become available for tree growth. Fire, excessive trampling by livestock, and erosion can result in the loss of nutrients. As a result, measures that prevent wildfires and protect the woodland from overgrazing are needed.

Aspect and position on the landscape are site characteristics that affect tree growth. They influence the amount of available sunlight, air drainage, soil temperature, and moisture relations. North- and east-facing slopes generally are the best sites for tree growth on uplands.

The Sibley-Higginsville association, which is described under the heading "General Soil Map Units," has a very small acreage of forest. The natural vegetation was dominantly prairie grasses, but timber grew in the drainageways.

The Knox-Menfro-Sibley and Weller-Winfield-Goss associations have a significant acreage of forest. The major forest type is white oak-northern red oak-hickory (fig. 27). Many other species are associated with the major forest species. Some of the more common ones are black oak, post oak, chinkapin oak, shingle oak, white ash, sugar maple, elm, and black walnut. Pure stands of white oak grow in areas of Menfro soils on north- and east-facing slopes. Under good management, these soils can produce trees of veneer quality. Knox soils are excellent sites for black walnut.

The Dockery-Colo and Haynie-Waldron-Leta associations on bottom land are forested in narrow strips in the riparian areas along the major rivers and tributaries, in frequently flooded areas, and in areas where drainage is inadequate for crop production. The typical species include cottonwood, silver maple, black willow, green ash, hackberry, pecan, American elm, and boxelder. Waldron soils can be managed for pecan trees. These highly productive soils respond well to intensive forest management.

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 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 an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. 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*, excess 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; *F*, a high content of rock fragments in the soil; and *L*, low strength. 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, F, and L.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where

Figure 27.—Oak-hickory forest in an area of Knox silt loam, 14 to 35 percent slopes.

the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed also are subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict the use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and the slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site 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.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

James L. Robinson, forester, Soil Conservation Service, helped prepare this section.

In much of Saline County, especially in the prairie areas, farmstead or feedlot windbreaks are needed. The Sibley-Higginsville, Macksburg-Arispe, and Monona-Joy-Winterset associations, which are described under the heading "General Soil Map Units," are in the prairie areas. Farmstead windbreaks protect areas around farmsteads from windblown snow, beautify the areas, reduce windchill, and reduce home heating costs by 25 to 33 percent *(4)*. Windbreaks also moderate the local climate; protect livestock, fruit trees, and gardens; and provide habitat for wildlife, especially in intensively cropped areas.

Field windbreaks can be useful on bottom land and in other areas used extensively for row crops. They have significantly improved crop yields. Also, they tend to moderate the extremes of cold or hot, dry, windy conditions. They have the greatest impact on crop yields in years when these conditions prevail.

A planned system of windbreaks, alone or in combination with other management practices, is effective in controlling soil blowing. Soil blowing is a hazard mainly on large fields of crops in areas of the Monona-Joy-Winterset association. It damages the fields by destroying drainage patterns and by removing productive soil layers and plant nutrients. Also, the abrasive action of windblown soil particles can damage new seedlings.

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, 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

Saline County has a mixture of cropland, grassland, and woodland. The recreational opportunities in the county are mainly land based. The public land in the state wildlife management areas called Blind Pony Lake, Grand Pass, and Marshall Junction provide opportunities for camping, hiking, and hunting. Blind Pony Lake, which is almost 200 acres in size, is used by fishermen. The Blackwater River, which flows through the southern part of the county, provides excellent opportunities for catching catfish. Fish also are caught in the Missouri River. The combination of farmland and rolling topography has resulted in good opportunities for upland game hunting.

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 sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational 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 are gently sloping 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 or a hardpan 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

Saline County is one of the 13 counties in Missouri that make up the West Prairie Zoogeographic Region *(10)*. Prior to cultivation, the primary vegetation was tall prairie grasses and oak-hickory forests were along the major streams. In 1987, about 17 percent of the acreage in the survey area was pasture and few areas of prairie remained. About 70 percent of the acreage was cropland, and 10 percent was woodland. The problems affecting wildlife include the loss of habitat through conversion to farming and the enlargement of fields. Another problem is the lack of suitable edge growth in transitional zones between areas covered by different types of vegetation.

Grand Pass Wildlife Area, Blind Pony Wildlife Area, and two other wildlife areas are the only public hunting lands in the survey area. On the vast majority of the wildlife habitat, which is controlled by private landowners, obtaining access for hunting is becoming more difficult as additional land is posted. The game species of wildlife are primarily those that prefer openland habitat.

The songbird population is high in each association described in the section "General Soil Map Units." The furbearer population also is high. Raccoon, opossum, muskrat, coyote, mink, and beaver are the chief furbearers trapped in the survey area.

More than half of the acreage in the Haynie-Waldron-Leta, Monona-Joy-Winterset, Sibley-Higginsville, Dockery-Colo, and Macksburg-Arispe associations is cropland or grassland. These associations provide the primary habitat for the openland wildlife in the survey area. Small tracts of timber, waterways, hedgerows, fence rows, and other areas of woody or brushy cover in these associations provide the edge growth essential for the majority of openland species. These key areas of habitat are disappearing where the soils are intensively cultivated. The Conservation Reserve Program, which pays landowners to plant grass or trees on highly erodible fields, is likely to improve the habitat. In 1987, the county had about 6,000 acres in the program.

The quail population is moderate in the survey area. The rabbit population is low. Usually, the dove population also is low, but it increases during migratory flights in the fall hunting season. The population of ring-necked pheasants, which inhabit the northern part of the survey area, is low.

About 30 percent of the acreage in the Knox-Menfro-Sibley and Weller-Winfield-Goss associations is woodland. These are the only associations in the survey area that have a significant acreage of woodland. The deer and turkey populations are moderate and are increasing (fig. 28). The squirrel population is high. The woodcock population, which is usually low, increases in fall as a result of migratory flights.

Habitat for wetland wildlife is scarce in the survey area. It is available only in areas of the Haynie-Waldron-Leta and Dockery-Colo associations. Many areas in these associations formerly were wetlands but have been drained. Only a few small areas of natural wetlands remain. Part of the Grand Pass Wildlife Area is being converted back to permanent or seasonal wetland. High populations of Canada geese and ducks frequent the bottom land during periods of high water in the fall. A permanent flock of giant Canada geese inhabits Blind Pony Lake.

The survey area has more than 175 miles of perennial streams. The Missouri and Blackwater Rivers and Salt Fork Creek provide opportunities for fishing. The Missouri River is fished for carp, buffalo, and flathead and channel catfish. Bluegill, crappie, largemouth bass, and flathead and channel catfish are caught in the major streams.

Opportunities for fishing also are available at the community lake near Malta Bend, at the lake in the Blind Pony Wildlife Area, in small ponds in the other wildlife areas, and in water areas in the two state parks. The impoundments are inhabited mainly by largemouth bass, channel catfish, bluegill, crappie, and walleye.

According to recent estimates, more than 70 percent of the farm ponds and small lakes in the survey area have been stocked with fish. These water areas provide opportunities for fishing if permission is obtained from the landowner.

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

Figure 28.—A white-tailed deer in an area of the Haynie-Waldron-Leta association. Deer are throughout the survey area.

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 hazard of flooding. Soil temperature and soil moisture also are 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, hazard of flooding, and slope. Soil temperature and soil moisture also are considerations. Examples of grasses and legumes are fescue, 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 hazard of flooding. Soil temperature and soil moisture also are considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, sunflowers, and ragweed.

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 hardwoods 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 blueberry. 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, cutgrass, cattail, 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. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, 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, 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 material, 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 should 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 evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and 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, a cemented pan, 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 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 or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 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 or to a cemented pan, 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 or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic material 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 or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan 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 the 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 resulting from rapid permeability in 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. 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 should be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium 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 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, a cemented pan, 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 to 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, a 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 a 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 depth to the water table is less than 1 foot. These soils 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. They 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 as much as 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 toxic material and 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, bedrock, and toxic material.

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 low in content of soluble salts, 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, stones, or soluble salts, 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 high 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 and for embankments, dikes, and levees. 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, a significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, 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 in 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, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

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, to a cemented pan, 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 the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan 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 or to a cemented pan 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 to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

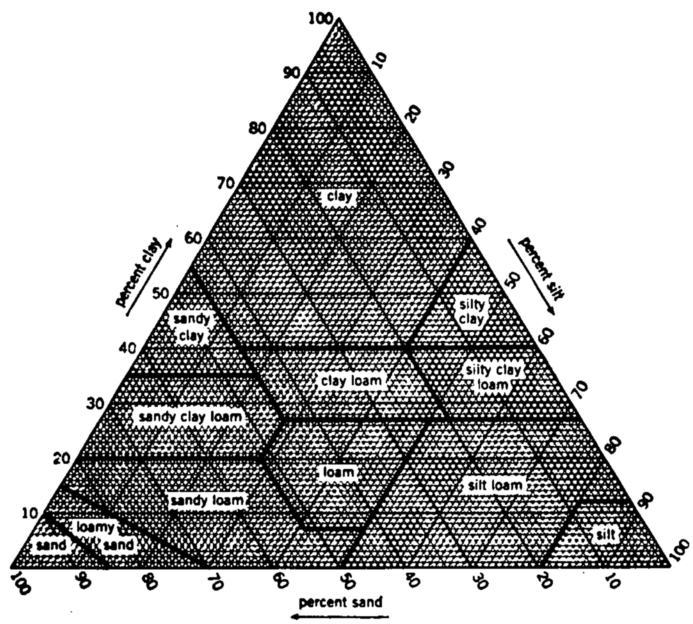

Figure 29.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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. 29). "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 3 inches to 10 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 content of clay in 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, 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 ⅓ 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. The 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. The 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 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. Coarse sands, 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 coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, 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 loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous 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. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

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 infiltration 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, or 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.

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 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 also is 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. Eleven 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 Argiudolls (*Argi*, meaning clay accumulation, plus *udoll*, the suborder of the Mollisols that has 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. An example is Aquic Argiudolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, 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, montmorillonitic, mesic Aquic Argiudolls.

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. 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" *(13)*. 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."

Ackmore Series

The Ackmore series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains along small streams. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Ackmore silt loam, 1,800 feet south and 1,250 feet west of the northeast corner of sec. 9, T. 50 N., R. 23 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; very friable; common very fine roots; slightly acid; abrupt smooth boundary.

C1—6 to 16 inches; stratified very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) silt loam; few fine faint grayish brown (10YR 5/2) strata; massive; very friable; common very fine roots; slightly acid; clear smooth boundary.

C2—16 to 29 inches; stratified very dark gray (10YR 3/1) and grayish brown (10YR 5/2) silt loam; few fine prominent dark yellowish brown (10YR 4/6) mottles; massive; very friable; common very fine roots; slightly acid; clear smooth boundary.

Ab—29 to 60 inches; black (10YR 2/1) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; few fine black accumulations of iron and manganese oxide; slightly acid.

The Ap horizon has chroma of 1 or 2. The C horizon has strata with value of 2 or 3 and chroma of 1 or 2. The Ab horizon has hue of 10YR, value of 2 or 3, and chroma of 1, or it is neutral in hue and has value of 2 or 3. It commonly is silty clay loam in which the content of clay is 27 to 35 percent, but the range includes silt loam.

Aholt Series

The Aholt series consists of deep, very poorly drained soils on flood plains along the Missouri River. These soils formed in calcareous, clayey alluvium. Permeability is very slow. Slopes range from 0 to 2 percent.

Typical pedon of Aholt clay, 100 feet north and 1,600 feet east of the southwest corner of sec. 23, T. 51 N., R. 23 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak fine angular blocky structure; very firm; common very fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

A—8 to 17 inches; very dark gray (10YR 3/1) clay; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate fine angular blocky structure; very firm; few distinct pressure faces; few fine accumulations of calcium carbonate; slight effervescence; mildly alkaline; clear smooth boundary.

Bg1—17 to 34 inches; dark gray (5Y 4/1) clay; common fine prominent olive brown (2.5YR 4/4) mottles; strong fine angular blocky structure; very firm; common shiny pressure faces; few fine accumulations of calcium carbonate; few crustacean shell fragments; few very fine roots; strong effervescence; mildly alkaline; gradual smooth boundary.

Bg2—34 to 42 inches; dark gray (5Y 4/1) clay; few fine prominent dark yellowish brown (10YR 4/6) mottles; strong fine angular blocky structure; very firm; few distinct shiny pressure faces; few fine accumulations of calcium carbonate; few crustacean shell fragments; few very fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

Bg3—42 to 60 inches; mottled dark gray (5Y 4/1) and gray (5Y 5/1) silty clay; few fine prominent dark yellowish brown (10YR 4/4) mottles; moderate fine angular blocky structure; very firm; few distinct shiny pressure faces; few fine accumulations of calcium carbonate; few very fine roots; strong effervescence; moderately alkaline.

The mollic epipedon ranges from 10 to 30 inches in thickness. The control section is calcareous throughout.

The Ap and A horizons have hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. The Bg horizon has hue of 2.5Y or 5Y, value of 2 to 6, and chroma of 1 or 2, or it is neutral in hue and has value of 2 to 6.

Arispe Series

The Arispe series consists of deep, somewhat poorly drained soils on uplands. These soils formed in loess. Permeability is moderately slow. Slopes range from 4 to 14 percent.

The Arispe soils in this county have a thinner dark upper layer than is definitive for the series. This difference, however, does not significantly alter the use and management of the soils.

Typical pedon of Arispe silt loam, 4 to 9 percent slopes, eroded, 1,500 feet north and 3,200 feet east of the southwest corner of sec. 14, T. 49 N., R. 21 W.

Ap—0 to 6 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate very fine granular structure; friable; few very fine roots; few fine accumulations of iron and manganese oxide; neutral; abrupt smooth boundary.

BA—6 to 9 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; few very fine roots; few fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt1—9 to 19 inches; dark grayish brown (10YR 4/2) silty clay; many fine distinct dark yellowish brown (10YR 4/4) mottles; moderate very fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; few distinct organic stains in root channels; slightly acid; clear smooth boundary.

Bt2—19 to 37 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate very fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; medium acid; clear smooth boundary.

Bt3—37 to 50 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) and few fine distinct light brownish gray (10YR 6/2) mottles; weak very fine subangular blocky structure; firm; few very fine roots; common distinct clay films in root channels; few fine accumulations of iron and manganese oxide; medium acid; clear smooth boundary.

C—50 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; few fine prominent strong brown (7.5YR 4/6) and common fine prominent yellowish brown (10YR 5/6) mottles; massive; firm; few very fine roots; few distinct clay films in root channels; medium acid.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 or 3. It is silty clay loam or silty clay. Some pedons have a BC horizon. The BC and C horizons have hue of 10YR or 2.5Y and value of 5 or 6. They typically are silty clay loam, but the range includes silt loam.

Bluelick Series

The Bluelick series consists of deep, well drained, moderately slowly permeable soils on side slopes in the uplands. These soils formed in loess and in the underlying cherty residuum. Slopes range from 9 to 20 percent.

Typical pedon of Bluelick silt loam, 14 to 20 percent slopes, 950 feet north and 1,850 feet east of the southwest corner of sec. 8, T. 48 N., R. 21 W.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, dark brown (10YR 3/3) crushed, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many medium roots; strongly acid; clear smooth boundary.

E—5 to 13 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; many medium roots; common distinct brown (10YR 5/3) silt coatings on faces of peds; common distinct very dark grayish brown (10YR 3/2) organic stains; strongly acid; clear smooth boundary.

Bt1—13 to 19 inches; dark brown (7.5YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; common fine roots; many prominent clay films on faces of peds; brown (10YR 5/3) silt coatings in root channels; strongly acid; gradual smooth boundary.

Bt2—19 to 28 inches; yellowish red (5YR 4/6) silty clay; moderate fine subangular blocky structure; firm; common medium roots; many prominent clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt3—28 to 38 inches; yellowish red (5YR 4/6) extremely cherty silty clay; strong fine subangular blocky structure; very firm; few fine roots; few faint clay films on faces of peds; about 70 percent chert fragments; very strongly acid; gradual smooth boundary.

2Bt4—38 to 60 inches; red (2.5YR 4/6) very cherty clay; strong fine subangular blocky structure; very firm; few fine roots; common distinct clay films on faces of peds; about 50 percent chert fragments; very strongly acid.

Depth to the 2Bt horizon is 20 to 40 inches. The content of clay ranges from 35 to 45 percent in the control section.

The A or Ap horizon has value of 3 or 4 and chroma of 2 or 3. The E horizon has value of 4 or 5 and chroma of 3 to 6. The Bt horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 6. The content of chert fragments in this horizon ranges from 0 to 10 percent. The 2Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 6. It is very cherty or extremely cherty silty clay or clay.

Booker Series

The Booker series consists of deep, very poorly drained soils on flood plains along the Missouri River. These soils formed in clayey alluvium. Permeability is very slow. Slopes range from 0 to 2 percent.

Typical pedon of Booker clay, 600 feet east and 1,750 feet north of the southwest corner of sec. 26, T. 52 N., R. 22 W.

Ap—0 to 7 inches; very dark gray (5Y 3/1) clay, dark gray (5Y 4/1) dry; moderate fine angular blocky structure; firm; few very fine roots; slightly acid; abrupt smooth boundary.

A—7 to 16 inches; very dark gray (5Y 3/1) clay, dark gray (5Y 4/1) dry; strong fine angular blocky structure; firm; few very fine roots; few prominent dark yellowish brown (10YR 3/4) stains; slightly acid; clear smooth boundary.

Bg1—16 to 31 inches; dark gray (5Y 4/1) clay; many fine prominent olive brown (2.5Y 4/4) mottles; strong fine angular blocky structure; very firm; few very fine roots; common shiny pressure faces; neutral; clear smooth boundary.

Bg2—31 to 60 inches; dark gray (5Y 4/1) clay; common fine prominent olive brown (2.5Y 4/4) mottles; strong fine angular blocky structure; very firm; few very fine roots; many shiny pressure faces; neutral.

The Ap and A horizons have hue of 2.5Y or 5Y, value of 2 or 3, and chroma of 1 or 2, or they are neutral in hue. The Bg horizon has hue of 2.5Y or 5Y, value of 3 or 4, and chroma of 1 or 2. It has mottles with hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 2 to 6.

Bremer Series

The Bremer series consists of deep, poorly drained soils on high flood plains. These soils formed in silty alluvium. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Typical pedon of Bremer silt loam, 2,000 feet east and 1,100 feet north of the southwest corner of sec. 9, T. 50 N., R. 22 W.

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

A—9 to 22 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; few very fine roots; slightly acid; clear smooth boundary.

Btg1—22 to 31 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; few fine distinct brown (10YR 4/3) mottles; moderate fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few very fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Btg2—31 to 41 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine faint grayish brown (10YR 5/2) and prominent yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Btg3—41 to 49 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct light brownish gray (2.5Y 6/2) and prominent yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; common fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Cg—49 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; massive; firm; few very fine roots; few distinct clay films in root channels; slightly acid.

The mollic epipedon ranges from 24 to 36 inches in thickness. The Ap and A horizons have value of 2 or 3. The Btg horizon has hue of 10YR to 5Y and chroma of 1 or 2. It has value of 3 in the upper part and value of 4 or 5 in the lower part. Some pedons have a BCg horizon. The BCg and Cg horizons have hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2.

Colo Series

The Colo series consists of deep, poorly drained, moderately permeable soils on narrow flood plains. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Colo silty clay loam, 2,440 feet south and 1,140 feet east of the northwest corner of sec. 28, T. 51 N., R. 23 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; weak very fine granular structure; friable; few very fine roots; slightly acid; abrupt smooth boundary.

A—8 to 19 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; firm; few very fine roots; few fine concretions of iron and manganese oxide; slightly acid; gradual smooth boundary.

Bg1—19 to 31 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate very fine subangular blocky structure; firm; few very fine roots; few fine concretions of iron and manganese oxide; slightly acid; gradual smooth boundary.

Bg2—31 to 60 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; firm; few very fine roots; few fine concretions of iron and manganese oxide; slightly acid.

The mollic epipedon is 36 or more inches thick. The content of clay ranges from 27 to 32 percent in the Ap and A horizons and from 30 to 35 percent in the Bg horizon. The Bg horizon has value of 2 or 3.

Dameron Series

The Dameron series consists of deep, well drained, moderately permeable soils on flood plains along small streams. These soils formed in silty and cherty alluvium (fig. 30). Slopes range from 0 to 3 percent.

Typical pedon of Dameron silt loam, 0 to 3 percent slopes, 230 feet west and 200 feet south of the northeast corner of sec. 25, T. 49 N., R. 25 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, very dark grayish brown (10YR 3/2) crushed, dark grayish brown (10YR 4/2) dry; moderate very fine granular structure; very friable; many fine and very fine roots; neutral; abrupt smooth boundary.

A1—8 to 22 inches; very dark gray (10YR 3/1) silt loam, very dark grayish brown (10YR 3/2) crushed, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; common very fine roots; slightly acid; clear smooth boundary.

A2—22 to 32 inches; black (10YR 2/1) silt loam, very dark brown (10YR 2/2) crushed, very dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; common very fine roots; about 7 percent chert fragments; slightly acid; abrupt smooth boundary.

2C—32 to 60 inches; very dark grayish brown (10YR 3/2) very cherty silty clay loam, dark grayish brown (10YR 4/2) dry; massive; firm; few very fine roots; about 50 percent chert fragments and 5 percent coarse chert; slightly acid.

The thickness of the mollic epipedon ranges from 24 to 60 inches. The Ap and A horizons have chroma of 1 to 3. The 2C horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. It is cherty or very cherty silty clay loam.

Darwin Series

The Darwin series consists of deep, very poorly drained soils on flood plains along the Missouri River. These soils formed in clayey alluvium. Permeability is very slow. Slopes range from 0 to 2 percent.

Figure 30.—Profile of Dameron silt loam, 0 to 3 percent slopes. This soil formed in silty and cherty alluvium.

Typical pedon of Darwin silty clay, 2,250 feet east and 2,500 feet north of the southwest corner of sec. 12, T. 51 N., R. 23 W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay, dark gray (10YR 4/1) dry; moderate fine granular structure; firm; common very fine roots; slightly acid; abrupt smooth boundary.

A—10 to 16 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; common very fine distinct dark brown (10YR 3/3) mottles; moderate very fine subangular blocky structure; very firm; few very fine roots; slightly acid; clear smooth boundary.

Bg1—16 to 25 inches; dark grayish brown (2.5Y 4/2) silty clay; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate very fine angular blocky structure; very firm; few very fine roots; common distinct organic coatings in root channels; slightly acid; clear smooth boundary.

Bg2—25 to 40 inches; dark gray (5Y 4/1) silty clay; few fine prominent dark brown (7.5YR 3/4) mottles; weak very fine angular blocky structure; firm; few very fine roots; few distinct organic coatings in root channels; neutral; gradual smooth boundary.

BCg—40 to 60 inches; dark gray (5Y 4/1) silty clay loam; few fine prominent dark brown (7.5YR 3/4) and few fine faint olive gray (5Y 4/2) mottles; weak fine subangular structure; firm; few very fine roots; neutral.

The mollic epipedon ranges from 10 to 24 inches in thickness. The Ap and A horizons have hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2, or they are neutral in hue and have value of 2 or 3. The Bg horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 5, and chroma of 1 or 2, or it is neutral in hue and has value of 4 or 5. It is dominantly silty clay, but in some pedons it is silty clay loam in the lower part. The BCg horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2, or it is neutral in hue. It is silty clay loam or silt loam.

Dockery Series

The Dockery series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Dockery silt loam, 2,400 feet east and 2,000 feet south of the northwest corner of sec. 13, T. 49 N., R. 20 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common very fine roots; neutral; abrupt smooth boundary.

C1—9 to 44 inches; stratified dark grayish brown (10YR 4/2), very dark gray (10YR 3/1), and grayish brown silt loam (10YR 5/2); common fine prominent dark yellowish brown (10YR 4/6) stains between strata; massive; friable; some thin light brownish gray (10YR 6/2) strata; neutral; clear smooth boundary.

C2—44 to 60 inches; very dark gray (10YR 3/1) silt loam; common fine prominent dark yellowish brown (10YR 4/6) stains between strata; massive; friable; some thin light grayish brown (10YR 5/2) strata; neutral.

The content of clay ranges from 18 to 30 percent in the 10- to 40-inch control section. The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The C horizon has hue of 10YR to 5Y, value of 3 to 5, and chroma of 1 to 3. It has mottles with hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 8. It is silt loam or silty clay loam.

Goss Series

The Goss series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in cherty limestone or dolomite residuum. Slopes range from 14 to 45 percent.

Typical pedon of Goss cherty silt loam, 14 to 45 percent slopes, 100 feet south and 1,300 feet east of the northwest corner of sec. 17, T. 48 N., R. 21 W.

A—0 to 6 inches; dark brown (10YR 4/3) cherty silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many medium roots; about 30 percent chert fragments; medium acid; clear smooth boundary.

E—6 to 12 inches; yellowish brown (10YR 5/4) very cherty silt loam; weak fine subangular blocky structure; friable; many medium roots; about 45 percent chert fragments; medium acid; clear smooth boundary.

Bt1—12 to 33 inches; yellowish red (5YR 5/6) very cherty silty clay; strong very fine subangular blocky structure; very firm; common medium roots; about 45 percent chert fragments; medium acid; clear smooth boundary.

Bt2—33 to 38 inches; red (2.5YR 4/6) very cherty clay; strong fine and very fine subangular blocky structure; very firm; common coarse roots; few faint clay films on faces of peds; about 35 percent chert fragments; strongly acid; clear smooth boundary.

Bt3—38 to 60 inches; red (2.5YR 4/6) very cherty clay; strong fine and very fine subangular blocky structure; very firm; many coarse roots; few faint clay films on faces of peds; few distinct black manganese oxide stains; about 60 percent chert fragments; strongly acid.

The A horizon has value of 3 or 4 and chroma of 2 to 4. The content of chert fragments in this horizon ranges from 10 to 35 percent. The E horizon has value of 4 or 5 and chroma of 3 or 4. It is very cherty or cherty silt loam. The B horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is very cherty silty clay or very cherty clay in the upper part and very cherty clay or extremely cherty clay in the lower part. The content of chert fragments in this horizon ranges from 35 to 70 percent.

Grable Series

The Grable series consists of deep, well drained, moderately permeable soils in the higher areas on flood plains along the Missouri River. These soils formed in calcareous, loamy alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Grable very fine sandy loam, loamy substratum, 2,900 feet west and 3,900 feet south of the northeast corner of sec. 33, T. 52 N., R. 19 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) very fine sandy loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; common very fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—9 to 22 inches; brown (10YR 4/3) very fine sandy loam; few prominent strata of brown (10YR 5/3) loamy fine sand; appears massive but has weak fine bedding planes; friable; common very fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

C2—22 to 39 inches; grayish brown (10YR 5/2) fine sand; appears massive but has weak fine bedding planes; loose; few very fine roots; strong effervescence; mildly alkaline; abrupt smooth boundary.

C3—39 to 60 inches; dark grayish brown (10YR 4/2) very fine sandy loam; few strata of grayish brown (10YR 5/2) loamy fine sand; few prominent dark yellowish brown (10YR 4/6) stains; appears massive but has weak fine bedding planes; friable; strong effervescence; mildly alkaline.

The Ap horizon has chroma of 1 or 2. The C horizon has value of 4 or 5 and chroma of 2 or 3. It is very fine sandy loam or silt loam. Some pedons have a 2C horizon, and some have a 3C horizon. These horizons have value of 4 or 5 and chroma of 2. The 2C horizon is fine sand or loamy sand. The 3C horizon is stratified fine sandy loam to silt loam.

Greenton Series

The Greenton series consists of deep, somewhat poorly drained, slowly permeable soils on uplands. These soils formed in a thin mantle of loess and in the underlying interbedded shale and limestone residuum. Slopes range from 5 to 9 percent.

The Greenton soils in this county have a thinner dark surface layer than is definitive for the series. This difference, however, does not significantly alter the use and management of the soils.

Typical pedon of Greenton silt loam, 5 to 9 percent slopes, eroded, 600 feet east and 1,200 feet south of the northwest corner of sec. 35, T. 50 N., R. 23 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; many very fine roots; few fine concretions of iron and manganese oxide; neutral; abrupt smooth boundary.

Bt1—9 to 20 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky structure; firm; common very fine roots; few distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; medium acid; clear smooth boundary.

Bt2—20 to 26 inches; dark grayish brown (10YR 4/2) silty clay; common fine prominent dark yellowish brown (10YR 4/6) mottles; strong fine subangular blocky structure; firm; common very fine roots; many prominent clay films on faces of peds; few fine concretions of iron and manganese oxide; medium acid; gradual smooth boundary.

2Bt3—26 to 37 inches; mottled dark grayish brown (2.5Y 4/2) and yellowish brown (10YR 5/4) silty clay; strong very fine subangular blocky structure; very firm; few very fine roots; few prominent clay films on faces of peds; few shiny pressure faces; few fine concretions of iron and manganese oxide; medium acid; gradual smooth boundary.

2Bt4—37 to 52 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/4) silty clay; moderate fine subangular blocky structure; very firm; few distinct clay films on faces of peds; common shiny pressure faces; common fine concretions of iron and manganese oxide; few fine shale fragments; slightly acid; gradual smooth boundary.

2Bt5—52 to 60 inches; mottled grayish brown (2.5Y 5/2) and light olive brown (2.5 5/4) silty clay; strong very fine subangular blocky structure; very firm; few distinct clay films on faces of peds; common shiny pressure faces; common fine concretions of iron and manganese oxide; few fine shale fragments; neutral.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 5. The 2Bt horizon has hue of 7.5YR to 2.5Y, value of 2 to 5, and chroma of 2 to 4.

Haynie Series

The Haynie series consists of deep, moderately well drained, moderately permeable soils on natural levees on flood plains along the Missouri River. These soils formed in calcareous alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Haynie silt loam, 5,020 feet east and 5,200 feet south of the northwest corner of sec. 30, T. 51 N., R. 23 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; few very fine roots; strong effervescence; mildly alkaline; abrupt smooth boundary.

C1—9 to 27 inches; grayish brown (10YR 5/2), stratified silt loam and very fine sandy loam; few distinct strata of brown (10YR 5/3) very fine sandy loam; appears massive but has weak bedding planes; friable; few very fine roots; strong effervescence; moderately alkaline; abrupt smooth boundary.

C2—27 to 39 inches; grayish brown (10YR 5/2) silt loam; common fine prominent yellowish brown (10YR 5/6) mottles and stains in the lower part; appears massive but has weak bedding planes; very friable; few very fine roots; strong effervescence; moderately alkaline; abrupt smooth boundary.

C3—39 to 60 inches; stratified grayish brown (10YR 5/2) very fine sandy loam and brown (10YR 5/3) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles and stains; appears massive but has weak bedding planes; very friable; strong effervescence; moderately alkaline.

The Ap horizon has hue of 10YR or 2.5Y. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. In some pedons it has mottles with hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 8. It is dominantly silt loam or very fine sandy loam, but strata of coarser or finer textured material are in some pedons.

Higginsville Series

The Higginsville series consists of deep, somewhat poorly drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 2 to 9 percent.

Typical pedon of Higginsville silt loam, 2 to 5 percent slopes, 50 feet south and 2,540 feet west of the northeast corner of sec. 29, T. 50 N., R. 23 W.

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

A—9 to 19 inches; black (10YR 2/1) silt loam, very dark grayish brown (10YR 3/2) crushed; weak very fine subangular blocky structure; very friable; few very fine roots; few distinct dark yellowish brown (10YR 4/4) stains; few distinct silt coatings on faces of peds; few very fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt1—19 to 28 inches; very dark grayish brown (10YR 3/2) silty clay loam; weak very fine subangular blocky structure; friable; few very fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; medium acid; clear smooth boundary.

Bt2—28 to 40 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) and few fine distinct light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; firm; common distinct clay films on faces of peds; few very fine accumulations of iron and manganese oxide; medium acid; clear smooth boundary.

Bt3—40 to 48 inches; grayish brown (10YR 5/2) and light brownish gray (2.5Y 6/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; medium acid; gradual smooth boundary.

C—48 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; massive; firm; few distinct clay films in root channels; few fine accumulations of iron and manganese oxide; slightly acid.

The mollic epipedon is 10 to more than 24 inches thick. The Ap and A horizons have value of 2 or 3 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 or 3. The C horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam or silt loam.

Joy Series

The Joy series consists of deep, somewhat poorly drained, moderately permeable soils on high terraces adjacent to flood plains along the Missouri River. These soils formed in loess. Slopes range from 0 to 2 percent.

Typical pedon of Joy silt loam, 1,360 feet west and 860 feet south of the northeast corner of sec. 16, T. 51 N., R. 22 W.

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

A—10 to 20 inches; very dark grayish brown (10YR 3/2) silt loam, very dark gray (10YR 3/1) crushed, dark gray (10YR 4/1) dry; weak very fine granular structure; very friable; few very fine roots; common distinct black organic coatings; neutral; clear smooth boundary.

AB—20 to 32 inches; very dark grayish brown (10YR 3/2) silt loam, dark brown (10YR 3/3) crushed, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; few very fine roots; few distinct black organic coatings; dark yellowish brown (10YR 4/6) stains; few very fine concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Bw—32 to 46 inches; yellowish brown (10YR 5/4) and grayish brown (2.5Y 5/2) silt loam; weak very fine subangular blocky structure; friable; few very fine roots; dark yellowish brown (10YR 4/6) stains; few very fine concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Cg—46 to 60 inches; gray (5Y 6/1) silt loam; massive; friable; dark yellowish brown (10YR 4/6) stains; few fine concretions of iron and manganese oxide; neutral.

The mollic epipedon ranges from about 24 to 36 inches in thickness. The Ap and A horizons have value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. The C horizon has hue of 5Y, 2.5Y, or 10YR, value of 4 to 7, and chroma of 1 to 4.

Knox Series

The Knox series consists of deep, well drained, moderately permeable soils on uplands adjacent to flood plains along the Missouri River. These soils formed in loess. Slopes range from 3 to 35 percent.

Typical pedon of Knox silt loam, 3 to 9 percent slopes, eroded, 1,300 feet east and 1,800 feet south of the northwest corner of sec. 26, T. 53 N., R. 21 W.

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

Bt1—8 to 12 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—12 to 22 inches; dark yellowish brown (10YR 4/6) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; many prominent clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt3—22 to 38 inches; dark yellowish brown (10YR 4/6) silty clay loam; moderate medium subangular blocky structure; firm; few very fine roots; many distinct clay films on faces of peds; medium acid; gradual smooth boundary.

C—38 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium prismatic structure; friable; few very fine roots; few faint clay films in root channels; slightly acid.

The Ap horizon has value and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6.

Knox silt loam, 14 to 35 percent slopes, eroded, has a lighter colored surface layer than is definitive for the series. This difference, however, does not significantly alter the use and management of the soil.

Ladoga Series

The Ladoga series consists of deep, moderately well drained soils on uplands and high terraces. These soils formed in loess. Permeability is moderately slow. Slopes range from 3 to 9 percent.

Typical pedon of Ladoga silt loam, 3 to 9 percent slopes, eroded, 1,250 feet north and 100 feet east of the southwest corner of sec. 17, T. 48 N., R. 20 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—8 to 17 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate very fine subangular blocky structure; friable; common very fine roots; common distinct clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—17 to 23 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; few black organic stains; many distinct clay films on faces of peds; medium acid; clear smooth boundary.

Bt3—23 to 36 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; few very fine roots; few black organic stains; few distinct clay films on faces of peds; medium acid; clear smooth boundary.

C—36 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; massive; firm; few very fine roots; few distinct strong brown stains; few distinct clay films on vertical cleavage faces; few fine concretions of iron and manganese oxide; medium acid.

The Ap horizon has value of 2 or 3 and chroma of 1 to 3. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. It is silty clay loam or silty clay. The C horizon is similar in color to the B horizon. It is silt loam or silty clay loam.

Leslie Series

The Leslie series consists of deep, poorly drained and somewhat poorly drained, slowly permeable soils on uplands and high stream terraces. These soils formed in loess. Slopes range from 0 to 5 percent.

Typical pedon of Leslie silt loam, 0 to 2 percent slopes, 2,000 feet west and 1,225 feet south of the northeast corner of sec. 16, T. 51 N., R. 22 W.

Ap—0 to 14 inches; very dark gray (10YR 3/1) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; friable; few very fine roots; neutral; clear smooth boundary.

E—14 to 24 inches; dark grayish brown (10YR 4/2) silt loam; few fine distinct dark yellowish brown (10YR 3/6) mottles; weak very fine granular structure; very friable; few very fine roots; many prominent silt coatings on faces of peds; slightly acid; clear smooth boundary.

Btg1—24 to 30 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine distinct dark yellowish brown (10YR 3/6) mottles; weak very fine subangular blocky structure; firm; few very fine roots; few distinct silt coatings on faces of peds; few distinct clay films on faces of peds; medium acid; clear smooth boundary.

Btg2—30 to 35 inches; dark grayish brown (10YR 4/2) silty clay; common fine prominent dark yellowish brown (10YR 4/6) and few fine faint light brownish gray (10YR 6/2) mottles; moderate very fine subangular blocky structure; very firm; few very fine roots; common prominent clay films on faces of peds; medium acid; clear smooth boundary.

Btg3—35 to 42 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; weak very fine subangular blocky structure; firm; few very fine roots; common prominent clay films on faces of peds; medium acid; gradual smooth boundary.

Btg4—42 to 52 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; weak very fine subangular blocky structure; firm; few distinct clay films in root channels; slightly acid; gradual smooth boundary.

Cg—52 to 60 inches; light brownish gray (2.5Y 6/2) silt loam; few fine prominent yellowish brown (10YR 5/8) mottles; massive; firm; few distinct clay films in root channels; slightly acid.

The content of clay ranges from 35 to 45 percent in the control section. The Ap horizon has value of 2 or 3. The E horizon has value of 4 to 6 and chroma of 1 or 2. The Btg horizon has value of 4 to 6 and chroma of 1 or 2 in the upper part and hue of 10YR or 2.5Y in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2.

Leta Series

The Leta series consists of deep, somewhat poorly drained soils on flood plains along the Missouri River. These soils formed in 20 to 40 inches of clayey alluvium, which is underlain by loamy alluvium. Permeability is slow in the upper part of the profile and moderate in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Leta silty clay, 3,100 feet west and 100 feet north of the southeast corner of sec. 21, T. 52 N., R. 22 W.

Ap—0 to 3 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; firm; common very fine roots; neutral; abrupt smooth boundary.

A—3 to 13 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; weak medium subangular blocky structure; very firm; common very fine roots; few fine accumulations of iron and manganese oxide; neutral; clear smooth boundary.

Bw1—13 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay; strong fine subangular blocky structure; very firm; common very fine roots; few distinct organic stains on faces of peds; few crustacean shell fragments; slight effervescence; mildly alkaline; clear smooth boundary.

Bw2—26 to 37 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine distinct olive brown (2.5Y 4/4) mottles; moderate medium subangular blocky structure; very firm; few very fine roots; few crustacean shell fragments; strong effervescence; mildly alkaline; abrupt smooth boundary.

2C—37 to 60 inches; grayish brown (2.5Y 5/2) very fine sandy loam; many fine prominent dark yellowish brown (10YR 4/6) mottles; appears massive but has weak bedding planes; very friable; few very fine roots; few prominent dark brown (7.5YR 3/4) stains in root channels; strong effervescence; moderately alkaline.

The mollic epipedon ranges from 10 to about 20 inches in thickness. The Ap and A horizons have value of 2 or 3. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam or silty clay. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It commonly is stratified silt loam or very fine sandy loam, but in some pedons it has thin layers of finer or coarser textured material.

Levasy Series

The Levasy series consists of deep, poorly drained soils on flood plains along the Missouri River. These soils formed in 20 to 38 inches of clayey alluvium, which is underlain by loamy alluvium. Permeability is slow in the upper part of the profile and moderate in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Levasy silty clay, 100 feet west and 2,780 feet south of the northeast corner of sec. 15, T. 51 N., R. 23 W.

Ap—0 to 4 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak very fine subangular blocky structure; firm; few very fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

A—4 to 12 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate fine angular blocky structure; firm; few very fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

Bg1—12 to 26 inches; dark gray (10YR 4/1) silty clay; common fine distinct grayish brown (2.5Y 5/2) and few fine distinct dark yellowish brown (10YR 4/4) mottles; strong fine and very fine angular blocky structure; firm; few very fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

Bg2—26 to 36 inches; dark gray (5Y 4/1) and grayish brown (2.5Y 5/2) silty clay; few fine prominent dark yellowish brown (10YR 4/4) mottles; strong fine and very fine angular blocky structure; firm; few very fine roots; few fine yellowish brown stains on horizontal cleavage faces; slight effervescence; mildly alkaline; clear smooth boundary.

2Cg—36 to 60 inches; olive gray (5Y 5/2) very fine sandy loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; appears massive but has weak bedding planes; very friable; few very fine roots; few faint clay films in root channels; few thin strata of grayish brown (2.5Y 5/2) silty clay loam; slight effervescence; moderately alkaline.

The mollic epipedon ranges from 10 to 24 inches in thickness. The clayey upper part of the profile ranges from 20 to 38 inches in thickness. Free carbonates are throughout the profile.

The Ap horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. The A horizon has hue of 10YR to 5Y, value of 2 or 3, and chroma of 1 or 2. The Bg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 1 or 2. The 2C horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 or 2. It is very fine sandy loam or silt loam.

Lindley Series

The Lindley series consists of deep, moderately well drained soils on uplands. These soils formed in glacial till. Permeability is moderately slow. Slopes range from 14 to 35 percent.

Typical pedon of Lindley silt loam, 14 to 35 percent slopes, 2,620 feet west and 1,890 feet north of the southeast corner of sec. 13, T. 50 N., R. 21 W.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many medium roots; strongly acid; clear smooth boundary.

E—5 to 10 inches; light yellowish brown (10YR 6/4) silt loam; weak fine granular structure; friable; common medium roots; common distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; few fine concretions of iron and manganese oxide; very strongly acid; gradual smooth boundary.

Bt1—10 to 14 inches; yellowish brown (10YR 5/4) clay loam; moderate very fine subangular blocky structure; firm; common medium roots; few distinct light brownish gray silt coatings on faces of peds; few distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt2—14 to 20 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct brown (10YR 5/3) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; very firm; common coarse roots; few distinct light brownish gray (10YR 6/2) silt coatings in root channels; common distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt3—20 to 29 inches; yellowish brown (10YR 5/4) and pale brown (10YR 6/3) clay loam; moderate medium subangular blocky structure; very firm; common coarse roots; few prominent clay films on faces of peds; few pebbles; very strongly acid; gradual smooth boundary.

Bt4—29 to 36 inches; light brownish gray (2.5Y 6/2) clay loam; many prominent yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; very firm; common very fine roots; few prominent clay films on faces of peds; very strongly acid; gradual smooth boundary.

C—36 to 60 inches; light brownish gray (2.5Y 6/2) clay loam; few fine prominent yellowish brown (10YR 5/4) mottles; massive; firm; common very fine roots; very strongly acid.

The content of clay ranges from 25 to 35 percent in the control section. The A horizon has value of 3 or 4 and chroma of 1 or 2. The E horizon has value of 5 or 6 and chroma of 2 to 4. The Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 6. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 4.

Macksburg Series

The Macksburg series consists of deep, somewhat poorly drained soils on uplands and high stream terraces. These soils formed in loess. Permeability is moderately slow. Slopes range from 1 to 4 percent.

Typical pedon of Macksburg silt loam, 1 to 4 percent slopes, 600 feet south and 300 feet west of the northeast corner of sec. 24, T. 49 N., R. 23 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many very fine roots; slightly acid; abrupt smooth boundary.

A—8 to 15 inches; very dark gray (10YR 3/1) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; few very fine roots; few fine concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

BA—15 to 24 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; firm; few very fine roots; few fine concretions of iron and manganese oxide; medium acid; clear smooth boundary.

Bt1—24 to 33 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine prominent dark yellowish brown (10YR 4/4) mottles; strong fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; common fine concretions of iron and manganese oxide; medium acid; clear smooth boundary.

Bt2—33 to 43 inches; dark grayish brown (2.5Y 4/2) silty clay loam; many fine prominent yellowish brown (10YR 5/6) and common fine prominent strong brown (7.5YR 5/6) mottles; strong fine subangular blocky structure; firm; few distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; medium acid; clear smooth boundary.

BC—43 to 60 inches; mottled grayish brown (2.5Y 5/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) silty clay loam; weak very fine subangular blocky structure; firm; few fine concretions of iron and manganese oxide; medium acid.

The Ap and A horizons have value of 2 or 3 and chroma of 1 or 2. The upper part of the Bt horizon has hue of 10YR or 2.5Y and chroma of 2 to 4. The lower part has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 2 to 6. Some pedons have a C horizon. The BC and C horizons have hue of 5Y to 7.5YR, value of 4 to 6, and chroma of 2 to 6. They are silty clay loam or silt loam.

Mandeville Series

The Mandeville series consists of moderately deep, moderately well drained and well drained, moderately permeable soils on uplands. These soils formed in acid shale residuum. Slopes range from 5 to 30 percent.

Typical pedon of Mandeville silt loam, 5 to 9 percent slopes, eroded, 1,300 feet east and 900 feet south of the northwest corner of sec. 8, T. 49 N., R. 22 W.

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many very fine roots; few fine accumulations of iron and manganese oxide; about 3 percent shale fragments; slightly acid; abrupt smooth boundary.

Bt1—6 to 11 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; many very fine roots; few distinct clay films on faces of peds; many prominent silt coatings in root channels; few fine accumulations of iron and manganese oxide; about 10 percent shale fragments; strongly acid; clear smooth boundary.

Bt2—11 to 17 inches; dark yellowish brown (10YR 4/6) channery silty clay loam; few fine distinct strong brown (7.5YR 4/6) mottles; moderate fine subangular blocky structure; firm; common very fine roots; many distinct clay films on faces of peds; few distinct silt coatings in root channels; few fine accumulations of iron and manganese oxide; about

20 percent shale fragments; strongly acid; gradual smooth boundary.

Bt3—17 to 24 inches; yellowish brown (10YR 5/6) channery silty clay loam; few fine prominent strong brown (7.5YR 4/6) mottles; weak medium subangular blocky structure; firm; few very fine roots; common prominent clay films on faces of peds; few fine accumulations of iron and manganese oxide; about 25 percent shale fragments; medium acid; gradual smooth boundary.

BC—24 to 32 inches; mottled light olive gray (5Y 6/2) and yellowish brown (10YR 5/6) channery silty clay loam; weak medium platy structure; firm; few very fine roots; few distinct clay films on cleavage faces; few fine accumulations of iron and manganese oxide; about 30 percent shale fragments; medium acid; gradual smooth boundary.

Cr—32 to 60 inches; mottled light olive gray (5Y 6/2) and yellowish brown (10YR 5/6) soft, weathered, acid shale.

The Ap or A horizon has value of 4 or 5 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6. The content of shale fragments in this horizon ranges from 10 to 25 percent. The BC horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 2 to 6.

McGirk Series

The McGirk series consists of deep, poorly drained, slowly permeable soils on concave toe slopes and high stream terraces. These soils formed in alluvium and local colluvium. Slopes range from 2 to 5 percent.

Typical pedon of McGirk silt loam, 2 to 5 percent slopes, 100 feet south and 1,700 feet east of the northwest corner of sec. 16, T. 49 N., R. 19 W.

Ap—0 to 8 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; very friable; common very fine roots; neutral; abrupt smooth boundary.

E—8 to 16 inches; light brownish gray (2.5Y 6/2) silt loam; weak medium platy structure; very friable; few very fine roots; slightly acid; clear smooth boundary.

Btg1—16 to 21 inches; grayish brown (10YR 5/2) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; few very fine roots; few prominent silt coatings on faces of peds; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Btg2—21 to 26 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few very fine roots; few prominent silt coatings on faces of peds; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; medium acid; clear smooth boundary.

Btg3—26 to 48 inches; dark grayish brown (10YR 4/2) silty clay; few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; very firm; few very fine roots; many prominent clay films on faces of peds; few fine accumulations of iron and manganese oxide; strongly acid; gradual smooth boundary.

Btg4—48 to 60 inches; grayish brown (10YR 5/2) silty clay loam; few fine prominent dark yellowish brown (10YR 4/6) mottles; weak medium subangular blocky structure; firm; few very fine roots; common prominent clay films on faces of peds; medium acid.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The E horizon has value of 6 or 7. The Btg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2.

Menfro Series

The Menfro series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 3 to 35 percent.

Typical pedon of Menfro silt loam, 3 to 9 percent slopes, eroded, 500 feet east and 300 feet south of the northwest corner of sec. 13, T. 50 N., R. 19 W.

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

Bt1—8 to 18 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine subangular blocky structure; firm; few very fine roots; few faint silt coatings in root channels; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; neutral; clear smooth boundary.

Bt2—18 to 28 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; few distinct silt coatings in root channels; many distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; medium acid; gradual smooth boundary.

Bt3—28 to 39 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine subangular blocky structure; firm; few very fine roots; few distinct silt coatings in root channels; common distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; medium acid; gradual smooth boundary.

Bt4—39 to 60 inches; brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable; few very fine roots; common distinct clay films in root channels; common distinct silt coatings in root channels; common prominent strong brown (7.5YR) 4/6 stains; medium acid.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an E horizon, which has value of 4 or 5 and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR and chroma of 3 or 4.

Moko Series

The Moko series consists of shallow, somewhat excessively drained soils in glade areas on uplands. These soils formed in limestone residuum. Permeability is moderately slow. Slopes range from 9 to 45 percent.

Typical pedon of Moko very flaggy silty clay loam, in an area of Moko-Rock outcrop complex, 9 to 45 percent slopes, 1,200 feet west and 700 feet north of the southeast corner of sec. 35, T. 49 N., R. 19 W.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) very flaggy silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; many coarse roots; about 55 percent limestone fragments; neutral; clear smooth boundary.

A2—2 to 12 inches; very dark grayish brown (10YR 3/2) very flaggy silty clay loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; friable; many coarse roots; about 60 percent limestone fragments; neutral; abrupt irregular boundary.

R—12 inches; hard limestone bedrock.

The depth to bedrock ranges from 4 to 20 inches. The content of coarse fragments ranges from 35 to 75 percent in the solum.

The A horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have a Bw horizon. This horizon has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 2 to 4. It is very flaggy or extremely flaggy silty clay loam or very flaggy silty clay.

Moniteau Series

The Moniteau series consists of deep, poorly drained soils on high flood plains. These soils formed in alluvium. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Typical pedon of Moniteau silt loam, 1,200 feet west and 80 feet north of the southeast corner of sec. 24, T. 49 N., R. 20 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common very fine roots; few fine accumulations of iron and manganese oxide; slightly acid; abrupt smooth boundary.

E—6 to 15 inches; light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) silt loam; few fine distinct dark yellowish brown (10YR 3/6) mottles; weak fine granular structure; friable; few very fine roots; few fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Btg1—15 to 27 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine distinct dark yellowish brown (10YR 3/6) mottles; weak very fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; strongly acid; gradual smooth boundary.

Btg2—27 to 39 inches; dark grayish brown (10YR 4/2) silty clay loam; common distinct dark yellowish brown (10YR 3/6) mottles; moderate very fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; strongly acid; gradual smooth boundary.

Btg3—39 to 60 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) silty clay loam; common fine distinct dark yellowish brown (10YR 3/6) mottles; weak very fine subangular blocky structure; firm; few distinct clay films in root channels; few fine concretions of iron and manganese oxide; medium acid.

In the control section, the content of clay ranges from 27 to 35 percent and the content of fine sand or coarser sand ranges from 5 to 15 percent. The Ap horizon has value of 4 or 5 and chroma of 1 or 2. The E horizon has value of 4 to 7 and chroma of 1 or 2. Some pedons have a C horizon. The Btg and C horizons have hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. The C horizon is silty clay loam or silt loam.

Monona Series

The Monona series consists of deep, well drained, moderately permeable soils on high stream terraces. These soils formed in loess. Slopes range from 2 to 9 percent.

Typical pedon of Monona silt loam, 2 to 5 percent slopes, 2,520 feet north and 620 feet west of the southeast corner of sec. 8, T. 51 N., R. 22 W.

Ap—0 to 12 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; very friable; few very fine roots; neutral; abrupt smooth boundary.

A—12 to 23 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; very friable; few very fine roots; neutral; gradual smooth boundary.

Bw1—23 to 33 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; very friable; few very fine roots; slightly acid; clear smooth boundary.

Bw2—33 to 46 inches; dark yellowish brown (10YR 3/4) silt loam; weak fine subangular blocky structure; very friable; few very fine roots; slightly acid; gradual smooth boundary.

BC—46 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; weak very fine subangular blocky structure; very friable; few very fine roots; slightly acid.

The Ap and A horizons have chroma of 1 or 2. The Bw horizon has chroma of 2 to 4 in the upper part and value of 4 or 5 and chroma of 3 or 4 in the lower part. It is silt loam or silty clay loam. Some pedons have a C horizon. The BC and C horizons have hue of 10YR to 5Y, value of 4 or 5, and chroma of 2 to 6.

Moville Series

The Moville series consists of deep, somewhat poorly drained soils on flood plains along the Missouri River. These soils formed in recently deposited silty alluvium and in the underlying older clayey alluvium. Permeability is moderate in the silty upper part of the profile and very slow in the clayey lower part. Slopes range from 0 to 2 percent.

Typical pedon of Moville silt loam, 2,400 feet north and 500 feet east of the southwest corner of sec. 7, T. 51 N., R. 23 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; common fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

C—7 to 22 inches; stratified dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; massive; very friable; common fine roots; few fine yellowish brown (10YR 5/6) stains; few strata of prominent very dark gray (10YR 3/1) silty clay loam; slight effervescence; mildly alkaline; clear smooth boundary.

2Ab—22 to 45 inches; very dark gray (2.5Y 3/0) silty clay; few fine prominent dark yellowish brown (10YR 4/4) mottles; moderate very fine subangular blocky structure; few very fine roots; few fine distinct yellowish brown (10YR 5/6) stains; neutral; clear smooth boundary.

2Bg1—45 to 53 inches; dark gray (2.5Y 4/0) silty clay; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate very fine subangular blocky structure; very firm; few very fine roots; neutral; clear smooth boundary.

2Bg2—53 to 60 inches; gray (2.5Y 5/1) silty clay; massive; firm; neutral.

The silty upper part of the profile ranges from 18 to 30 inches in thickness. The lower part is silty clay or clay.

The Ap horizon has value of 3 or 4. The C horizon has value of 3 to 5 and chroma of 1 to 3. The 2Ab horizon has hue of 5Y or 2.5Y and value of 2 or 3. The 2Bg horizon has hue of 5Y or 2.5Y, value of 3 to 5, and chroma of 1, or it is neutral in hue.

Newcomer Series

The Newcomer series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from acid sandstone and thin beds of silty and sandy shale. Slopes range from 9 to 35 percent.

Typical pedon of Newcomer silt loam, 9 to 14 percent slopes, eroded, 940 feet east and 2,000 feet south of the northwest corner of sec. 14, T. 52 N., R. 20 W.

Ap—0 to 7 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine granular structure; friable; common very fine roots; slightly acid; abrupt smooth boundary.

Bt1—7 to 15 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; common very fine roots; common distinct dark brown (10YR 3/3) organic stains; common distinct clay films on faces of peds; medium acid; gradual smooth boundary.

Bt2—15 to 27 inches; strong brown (7.5YR 5/6) loam; weak fine subangular blocky structure; friable; common distinct clay films in root channels and on faces of peds; few prominent black iron stains; about 5 percent sandstone fragments; strongly acid; abrupt wavy boundary.

Cr—27 to 60 inches; soft, weathered, acid sandstone bedrock.

The Ap horizon has chroma of 2 or 3. The Bt horizon has chroma of 3 to 6.

Nodaway Series

The Nodaway series consists of deep, moderately well drained, moderately permeable soils on flood plains and alluvial fans along tributary streams of the Missouri River. These soils formed in silty recent alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Nodaway silt loam, 600 feet north and 250 feet east of the southwest corner of sec. 7, T. 51 N., R. 23 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common very fine roots; slightly acid; abrupt smooth boundary.

C1—8 to 13 inches; mixed brown (10YR 4/3) and dark brown (10YR 3/3) silt loam; massive; friable; few very fine roots; neutral; abrupt smooth boundary.

C2—13 to 23 inches; stratified brown (10YR 5/3) and dark brown (10YR 3/3) silt loam; massive; friable; few very fine roots; neutral; abrupt smooth boundary.

C3—23 to 34 inches; stratified dark brown (10YR 3/3) and yellowish brown (10YR 5/4) silt loam; massive; friable; few very fine roots; neutral; abrupt smooth boundary.

C4—34 to 53 inches; stratified brown (10YR 4/3) and yellowish brown (10YR 5/4) silt loam; few fine distinct grayish brown (10YR 5/2) mottles; massive; friable; few very fine roots; neutral; abrupt smooth boundary.

C5—53 to 60 inches; very dark grayish brown (10YR 3/2) silt loam; few fine yellowish brown (10YR 5/4) strata; massive; friable; few very fine roots; neutral.

The C horizon has value of 3 to 5 and chroma of 2 to 4. It typically is silt loam, but the range includes silty clay loam.

Plainfield Series

The Plainfield series consists of deep, excessively drained, rapidly permeable soils on side slopes in the uplands. These soils formed in loamy glacial outwash. Slopes range from 14 to 35 percent.

Typical pedon of Plainfield loamy sand, 14 to 35 percent slopes, 550 feet east and 710 feet south of the northwest corner of sec. 7, T. 50 N., R. 20 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) loamy sand, brown (10YR 5/3) dry; weak medium granular structure; very friable; many medium roots; strongly acid; gradual smooth boundary.

E—4 to 14 inches; yellowish brown (10YR 5/4) sand; weak medium subangular blocky structure; very friable; many medium roots; very strongly acid; gradual smooth boundary.

Bw1—14 to 37 inches; very pale brown (10YR 7/4) sand; weak medium subangular blocky structure; loose; common medium roots; very strongly acid; gradual smooth boundary.

Bw2—37 to 52 inches; mixed brownish yellow (10YR 6/6) and very pale brown (10YR 7/4) sand; weak medium subangular blocky structure; loose; common medium roots; few distinct yellowish brown (10YR 5/6) horizontal bands of clay in the lower part; very strongly acid; gradual wavy boundary.

C—52 to 60 inches; very pale brown (10YR 7/3) sand; single grain; loose; few medium roots; few prominent brownish yellow (10YR 6/8) horizontal bands of clay; very strongly acid.

The A horizon has chroma of 2 or 3. The Bw and C horizons have value of 5 to 7 and chroma of 3 to 6.

Sampsel Series

The Sampsel series consists of deep, poorly drained, slowly permeable soils in the uplands. These soils formed in shale residuum. Slopes range from 5 to 9 percent.

Typical pedon of Sampsel silty clay loam, 5 to 9 percent slopes, eroded, 1,000 feet south and 1,800 feet east of the northwest corner of sec. 29, T. 50 N., R. 23 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; firm; few very fine roots; few dark yellowish brown (10YR 4/6) stains; neutral; abrupt smooth boundary.

Btg1—10 to 18 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine prominent yellowish brown (10YR 5/4) and yellowish red (5YR 5/8) mottles; moderate fine subangular blocky structure; firm; few very fine roots; common prominent clay films on faces of peds; few fine accumulations of iron and manganese oxide; about 2 percent fine shale fragments; slightly acid; clear smooth boundary.

Btg2—18 to 29 inches; grayish brown (2.5Y 5/2) silty clay; many fine prominent yellowish brown

(10YR 5/6) and few fine prominent yellowish red (5YR 5/8) mottles; moderate fine subangular blocky structure; very firm; few very fine roots; common prominent clay films on faces of peds; many shiny pressure faces; few fine accumulations of iron and manganese oxide; about 2 percent fine shale fragments; neutral; gradual smooth boundary.

Btg3—29 to 39 inches; gray (5Y 6/1) and light olive brown (2.5Y 5/4) silty clay; common fine prominent yellowish brown (10YR 5/6) mottles; moderate very fine subangular blocky structure; very firm; few very fine roots; few distinct clay films in root channels; common shiny pressure faces; few fine accumulations of iron and manganese oxide; about 2 percent shale fragments; mildly alkaline; gradual smooth boundary.

Btg4—39 to 60 inches; gray (5Y 6/1) and yellowish brown (10YR 5/6) silty clay; few fine prominent light olive brown (2.5Y 5/4) mottles; weak very fine subangular blocky structure; very firm; few very fine roots; few distinct clay films in root channels; common shiny pressure faces; few fine accumulations of iron and manganese oxide; about 2 percent shale and limestone fragments; mildly alkaline.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Btg horizon has hue of 10YR to 5Y, value of 3 to 6, and chroma of 1 or 2. The content of clay in this horizon ranges from 36 to 48 percent.

Sarpy Series

The Sarpy series consists of deep, excessively drained, rapidly permeable soils on flood plains along the Missouri River. These soils formed in sandy alluvium. Slopes range from 0 to 4 percent.

Typical pedon of Sarpy loamy fine sand, 0 to 4 percent slopes, 4,400 feet west and 800 feet north of the southeast corner of sec. 6, T. 51 N., R. 22 W.

Ap—0 to 6 inches; dark brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; single grain; loose; few very fine roots; slight effervescence; moderately alkaline; abrupt smooth boundary.

C—6 to 60 inches; grayish brown (2.5Y 5/2) fine sand; single grain; loose; few very fine roots; strong effervescence; mildly alkaline.

The Ap horizon has value of 3 to 5 and chroma of 1 to 3. The C horizon has value of 4 to 6 and chroma of 2 to 4. It is dominantly fine sand, but the range includes sand, loamy sand, and loamy fine sand.

Sibley Series

The Sibley series consists of deep, well drained, moderately permeable soils in the uplands. These soils formed in loess. Slopes range from 2 to 14 percent.

Typical pedon of Sibley silt loam, 2 to 5 percent slopes, 1,000 feet south and 2,700 feet east of the northwest corner of sec. 25, T. 50 N., R. 23 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; friable; few very fine roots; neutral; abrupt smooth boundary.

A—8 to 18 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; friable; few very fine roots; neutral; clear smooth boundary.

Bt1—18 to 27 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 4/3) dry; moderate very fine subangular blocky structure; friable; few very fine roots; few distinct clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—27 to 36 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate very fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; medium acid; clear smooth boundary.

Bt3—36 to 52 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) and few fine prominent yellowish brown (10YR 5/8) mottles; moderate very fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; medium acid; clear smooth boundary.

BC—52 to 60 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct light brownish gray (10YR 6/2) and few fine prominent yellowish brown (10YR 5/8) mottles; weak very fine subangular blocky structure; firm; medium acid.

In uneroded areas the mollic epipedon ranges from 24 to 36 inches in thickness. The Ap and A horizons have value and chroma of 2 or 3. The Bt horizon has value of 3 and chroma of 2 or 3 in the upper part and value of 3 to 5 and chroma of 3 or 4 in the lower part. The content of clay in this horizon ranges from 32 to 35 percent. The C horizon has value of 4 or 5 and chroma of 2 to 4. It commonly is silt loam, but in some pedons it is silty clay loam.

Sibley silt loam, 5 to 9 percent slopes, eroded, and Sibley silt loam, 9 to 14 percent slopes, eroded, have thinner dark upper horizons than is definitive for the series. These differences, however, do not significantly affect the use and management of the soils.

Snead Series

The Snead series consists of moderately deep, moderately well drained, slowly permeable soils in the uplands. These soils formed in material weathered from calcareous shale and thinly interbedded limestone. Slopes range from 9 to 14 percent.

The Snead soils in this county have a thinner dark surface layer than is definitive for the series. This difference, however, does not significantly affect the use and management of the soils.

Typical pedon of Snead silty clay loam, 9 to 14 percent slopes, eroded, 1,800 feet east and 2,150 feet north of the southwest corner of sec. 19, T. 49 N., R. 23 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; many very fine roots; slightly acid; abrupt smooth boundary.

Bw1—9 to 15 inches; grayish brown (10YR 5/2) silty clay; common fine prominent yellowish brown (10YR 5/6) mottles; few fine distinct very dark grayish brown (10YR 3/2) organic stains; moderate fine subangular blocky structure; firm; common very fine roots; few fine accumulations of iron and manganese oxide; about 10 percent shale fragments; slightly acid; clear smooth boundary.

Bw2—15 to 21 inches; grayish brown (2.5Y 5/2) silty clay; common fine prominent brownish yellow (10YR 6/6) and common fine prominent strong brown (7.5YR 5/6) mottles; strong very fine subangular blocky structure; very firm; common very fine roots; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine accumulations of iron and manganese oxide; about 5 percent shale fragments; slightly acid; gradual smooth boundary.

Bw3—21 to 27 inches; grayish brown (2.5Y 5/2) and light olive gray (5Y 6/2) silty clay; common fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; very firm; few very fine roots; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine accumulations of iron and manganese oxide; about 5 percent shale fragments; slightly acid; gradual smooth boundary.

BC—27 to 32 inches; gray (5Y 5/1) and olive gray (5Y 5/2) silty clay; common fine prominent yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; very firm; few very fine roots; few fine accumulations of iron and manganese oxide; about 10 percent shale fragments; neutral; gradual smooth boundary.

C—32 to 35 inches; gray (5Y 5/1) and olive gray (5Y 5/2) silty clay; few fine prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very firm; few very fine roots; few fine accumulations of iron and manganese oxide; about 10 percent soft shale fragments; neutral; gradual smooth boundary.

Cr—35 to 60 inches; yellowish brown and gray, soft, weathered shale bedrock.

The content of shale fragments ranges from 0 to 10 percent above the bedrock. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The B horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 to 6. It is silty clay or clay. The BC and C horizons have the same range in color and texture as the B horizon.

Vesser Series

The Vesser series consists of deep, somewhat poorly drained, moderately permeable soils on high flood plains. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Vesser silt loam, 800 feet south and 1,800 feet east of the northwest corner of sec. 13, T. 49 N., R. 20 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; few very fine roots; slightly acid; abrupt smooth boundary.

E1—10 to 18 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; friable; few very fine roots; many distinct silt coatings on faces of peds; few distinct organic coatings in root channels; few distinct dark yellowish brown iron stains; medium acid; clear smooth boundary.

E2—18 to 24 inches; grayish brown (10YR 5/2) silt loam; weak fine subangular blocky structure; friable; few very fine roots; many distinct silt coatings on faces of peds; few prominent dark yellowish brown iron stains; medium acid; clear smooth boundary.

Btg1—24 to 37 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate fine subangular blocky structure; firm; few very fine roots; many distinct clay films on faces of peds; common distinct silt coatings in root channels; few fine accumulations of iron and manganese oxide; medium acid; gradual smooth boundary.

Btg2—37 to 48 inches; dark grayish brown (10YR 4/2) silty clay loam; many fine prominent dark yellowish brown (10YR 4/6) mottles; moderate medium subangular blocky structure; firm; few very fine roots; common prominent clay films on faces of peds; few distinct silt coatings in root channels; few fine accumulations of iron and manganese oxide; medium acid; gradual smooth boundary.

Btg3—48 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common fine prominent dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; few very fine roots; few distinct clay films in root channels; few fine accumulations of iron and manganese oxide; medium acid.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 3 to 5 and chroma of 1 or 2. The Btg horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2.

Waldron Series

The Waldron series consists of deep, somewhat poorly drained, slowly permeable soils on flood plains along the Missouri River. These soils formed in calcareous, stratified alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Waldron silty clay, 2,500 feet north and 200 feet east of the southwest corner of sec. 34, T. 52 N., R. 23 W.

Ap—0 to 10 inches; very dark gray (5Y 3/1) silty clay, dark gray (5Y 4/1) dry; strong very fine subangular blocky structure; firm; few very fine roots; few fine accumulations of iron and manganese oxide; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—10 to 17 inches; stratified very dark gray (2.5Y 3/1) and dark grayish brown (2.5Y 4/2) silty clay; massive; very firm; few very fine roots; few fine accumulations of iron and manganese oxide; slight effervescence; mildly alkaline; abrupt smooth boundary.

C2—17 to 36 inches; stratified dark grayish brown (2.5Y 4/2) silty clay and grayish brown (10YR 5/2) silt loam; massive; firm; few very fine roots; few fine prominent dark yellowish brown (10YR 4/6) mottles; strong effervescence; mildly alkaline; abrupt smooth boundary.

C3—36 to 60 inches; stratified dark gray (2.5Y 4/0) and very dark grayish brown (2.5Y 3/2) silty clay; massive; firm; few very fine roots; few fine lenses of grayish brown (10YR 5/2) silt loam; common fine prominent strong brown (7.5YR 4/6) mottles; violent effervescence; mildly alkaline.

The Ap horizon has hue of 10YR, 2.5Y, or 5Y, value of 2 or 3, and chroma of 1 or 2. The C horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 2 to 5 and chroma of 0 to 4. The content of clay ranges from 35 to 50 percent in the 10- to 40-inch control section. Thin lenses of coarser textured material are in the control section.

Weller Series

The Weller series consists of deep, moderately well drained, slowly permeable soils in the uplands. These soils formed in loess. Slopes are 2 to 14 percent.

Typical pedon of Weller silt loam, 5 to 9 percent slopes, eroded, 500 feet west and 2,200 feet south of the northeast corner of sec. 8, T. 48 N., R. 22 W.

Ap—0 to 5 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

BE—5 to 10 inches; yellowish brown (10YR 5/4) silty clay loam; few medium prominent strong brown (7.5YR 4/6) mottles; weak very fine subangular blocky structure; firm; common fine roots; common distinct silt coatings on faces of peds; few fine concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

Bt1—10 to 19 inches; yellowish brown (10YR 5/4) silty clay; common fine prominent strong brown (7.5YR 5/6) and common fine distinct grayish brown (10YR 5/2) mottles; moderate very fine subangular blocky structure; firm; common fine roots; common distinct clay films on faces of peds; common fine concretions of iron and manganese oxide; very strongly acid; gradual smooth boundary.

Bt2—19 to 35 inches; yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) silty clay; many medium prominent strong brown (7.5YR 5/6) mottles; moderate very fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; common fine concretions of iron and manganese oxide; strongly acid; gradual smooth boundary.

Bt3—35 to 58 inches; light brownish gray (10YR 6/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak very fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; common fine concretions of iron and manganese oxide; medium acid; gradual smooth boundary.

C—58 to 65 inches; light brownish gray (10YR 6/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; massive; firm; common fine concretions of iron and manganese oxide; slightly acid.

The Ap horizon has value of 3 or 4 and chroma of 1 or 2. It is silt loam to silty clay loam in areas where it has been mixed with the B horizon. Some pedons have an E horizon, which has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The upper part of the Bt horizon has value of 4 or 5. The lower part has value of 4 or 5 and chroma of 2 to 6. It is silty clay loam or silty clay.

Winfield Series

The Winfield series consists of deep, moderately well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 3 to 9 percent.

Typical pedon of Winfield silt loam, 3 to 9 percent slopes, eroded, 1,200 feet east and 1,050 feet south of the northwest corner of sec. 7, T. 50 N., R. 20 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; few fine roots; medium acid; abrupt smooth boundary.

Bt1—10 to 16 inches; yellowish brown (10YR 5/4) silty clay loam; weak very fine subangular blocky structure; friable; common very fine roots; few faint clay films on faces of peds; few very fine concretions of iron and manganese oxide; medium acid; clear smooth boundary.

Bt2—16 to 26 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine subangular blocky structure; firm; common very fine roots; common prominent clay films on faces of peds; few distinct silt coatings in root channels; few fine concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

Bt3—26 to 47 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct grayish brown (10YR 5/2) mottles; weak very fine subangular blocky structure; firm; few very fine roots; few prominent clay films on faces of peds; few distinct silt coatings in root channels; few fine concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

C—47 to 60 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct dark yellowish brown (10YR 4/6) and many fine prominent grayish brown (2.5Y 5/2) mottles; massive; firm; few very fine roots; few very fine concretions of iron and manganese oxide; medium acid.

The Ap horizon has chroma of 2 or 3. Some pedons have an E horizon, which has value of 4 to 6 and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The content of clay in the upper 20 inches of the argillic horizon ranges from 30 to 35 percent. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4.

Winterset Series

The Winterset series consists of deep, poorly drained soils on high terraces. These soils formed in loess. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Typical pedon of Winterset silt loam, 10 feet east and 50 feet north of the southwest corner of sec. 9, T. 51 N., R. 22 W.

Ap—0 to 12 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak very fine granular structure; friable; few very fine roots; neutral; abrupt smooth boundary.

A—12 to 24 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; few fine prominent strong brown (7.5YR 4/6) mottles; weak very fine subangular blocky structure; friable; few very fine roots; few prominent strong brown stains; few fine concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Btg1—24 to 36 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; few fine prominent strong brown (7.5YR 4/6) mottles; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few prominent strong brown stains; few fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Btg2—36 to 48 inches; dark gray (10YR 4/1) and very dark gray (10YR 3/1) silty clay loam; common fine prominent strong brown (7.5YR 4/6) mottles; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few prominent strong brown stains; common fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Btg3—48 to 55 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent strong brown (7.5YR 4/6) mottles; moderate fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; common fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

BCg—55 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent strong brown (7.5YR 4/6) mottles; weak very fine subangular blocky structure; firm; few distinct clay films in root channels; common fine accumulations of iron and manganese oxide; slightly acid.

The Btg horizon has hue of 10YR to 5Y and chroma of 1 or 2. It has value of 3 or 4 in the upper part and value or 4 or 5 in the lower part. The BCg horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2.

Wiota Series

The Wiota series consists of deep, well drained, moderately permeable soils on high flood plains. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Wiota silt loam, 1,700 feet east and 1,500 feet south of the northwest corner of sec. 73, T. 49 N., R. 20 W.

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

A—10 to 20 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; few very fine roots; very dark gray (10YR 3/1) organic coatings on faces of peds; slightly acid; clear smooth boundary.

Bt1—20 to 29 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; weak very fine subangular blocky structure; friable; few very fine roots; few distinct clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt2—29 to 38 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; many distinct clay films on faces of peds and in root channels; slightly acid; gradual smooth boundary.

Bt3—38 to 48 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds and in root channels; slightly acid; gradual smooth boundary.

C—48 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; few very fine roots; few distinct clay films in root channels and cracks; slightly acid.

The mollic epipedon ranges from about 18 to 32 inches in thickness. It includes the upper part of the Bt horizon in most pedons. The Ap and A horizons have value of 2 or 3 and chroma of 1 or 2. The lower part of the Bt horizon has value of 4 or 5 and chroma of 3 or 4. Some pedons have a C horizon. The BC and C horizons have value of 4 to 6 and chroma of 2 to 6.

Zook Series

The Zook series consists of deep, poorly drained, slowly permeable soils on flood plains. These soils formed in clayey alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Zook silty clay, 1,600 feet north and 1,600 feet west of the southeast corner of sec. 27, T. 49 N., R. 21 W.

Ap—0 to 8 inches; black (N 2/0) silty clay, dark gray (10YR 3/1) dry; moderate very fine subangular blocky structure; firm; many very fine roots; neutral; abrupt smooth boundary.

A1—8 to 15 inches; black (N 2/0) silty clay, dark gray (10YR 3/1) dry; moderate fine angular blocky structure; firm; many very fine roots; few prominent dark yellowish brown (10YR 4/4) stains; neutral; clear smooth boundary.

A2—15 to 26 inches; black (10YR 2/1) silty clay, dark gray (10YR 4/1) dry; moderate fine angular blocky structure; firm; common very fine roots; common prominent dark yellowish brown (10YR 4/4) stains; neutral; clear smooth boundary.

Bg1—26 to 41 inches; very dark gray (5Y 3/1) silty clay, gray (10YR 5/1) dry; few fine prominent dark yellowish brown (10YR 4/4) mottles; moderate fine angular blocky structure; firm; common very fine roots; common shiny pressure faces; mildly alkaline; clear smooth boundary.

Bg2—41 to 54 inches; dark gray (5Y 4/1) silty clay; common fine prominent light olive brown (2.5Y 5/4) mottles; moderate very fine angular blocky structure; very firm; few very fine roots; common shiny pressure faces; few fine accumulations of iron and manganese oxide; few crustacean shell fragments; mildly alkaline; gradual smooth boundary.

Bg3—54 to 60 inches; dark gray (5Y 4/1) silty clay; common fine prominent dark yellowish brown (10YR 4/6) and light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; very firm; few very fine roots; few fine accumulations of iron and manganese oxide; few fine accumulations of calcium carbonate; mildly alkaline.

The mollic epipedon ranges from 36 to 50 inches in thickness. The Ap and A horizons have hue of 10YR or are neutral in hue. The lower part of the A horizon has value of 2 or 3. Some pedons have a Cg horizon. The Bg and Cg horizons have hue of 10YR to 5Y and value of 2 to 5.

Formation of the Soils

Soil forms through processes that act on accumulated or deposited geologic material. The characteristics of the soil are determined by the type of parent material; the plant and animal life on and in the soil; the climate under which the soil-forming factors were active; relief, or lay of the land; and the length of time that the forces of soil formation have been active.

The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Plant and animal life, chiefly plants, are active factors of soil formation. The climate determines the amount of water available for leaching and the amount of heat available for physical and chemical changes. Climate and plant and animal life 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. Relief commonly modifies the effects of the other factors. Finally, time is required for the transformation of the parent material into a soil. Generally, a long time is required 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 about the effect of any one factor unless conditions are specified for the other four.

Parent Material

Parent material is the unconsolidated mass in which soil forms. The formation or deposition of this material is the first step in the development of a soil profile. The characteristics of the material determine the chemical and mineralogical composition of the soil. The soils in this survey area formed in four kinds of parent material, alone or in combination. These four are residuum; glacial material; loess, or wind-deposited material; and alluvium.

Residuum is parent material that weathers in place from the underlying bedrock. Typically, the bedrock has undergone intensive weathering for long periods. Greenton, Bluelick, and Snead soils formed partly or entirely in material weathered from shale interbedded with thin layers of limestone. In areas of Bluelick and Greenton soils, a thin layer of loess overlies the residual material. Sampsel soils formed in shale residuum. Goss soils formed in material weathered from cherty limestone.

Glacial parent material, which consists of clay, silt, sand, gravel, and a few boulders, was transported during periods of glaciation. Much of the glacial till was moved long distances, but some of it is of local origin. Lindley soils formed in glacial till.

Loess, or silty wind-transported material, is an extensive parent material in the survey area. The chief source of the loess was probably the flood plains along the Missouri River. The wind picked up material on the flood plains after the retreat of the last glacier. The deepest deposits of loess are on the hills bordering these flood plains. Sibley and Menfro soils formed in the loess on these hills. In areas farther from the source, the deposits of loess are thinner and contain more clay. In these areas, slopes commonly are gentler and the drainage of the soils is more restricted. The somewhat poorly drained Macksburg and Higginsville soils formed in the loess in these areas.

The soils on flood plains in the survey area formed in clayey, silty, and loamy alluvium. The alluvium was picked up on both near and distant uplands, transported by water, and deposited on the flood plains.

All of the soils on flood plains along the Missouri River formed in alluvium. The river sorted the alluvium as it overflowed its channel. As it lost velocity, the river began to deposit the sorted soil material. Sand was deposited first. Then, silt, which is finer textured than sand, was deposited as the floodwater continued to flow. Haynie and other loamy soils formed in these deposits. Clay settled and accumulated in areas of standing water in shallow swamps or in old river channels. Aholt soils formed in these areas.

Stream meandering and channel migration significantly affected the sorting and deposition of sediments. In areas where a stream suddenly abandoned some of its channels, the soils formed in clayey alluvium over loamy alluvium. Leta and Levasy soils are examples.

Small flood plains are along the creeks and rivers in the uplands. Dockery soils formed in alluvium derived from eroding, silty soils in the uplands.

Plant and Animal Life

Plants and animals living on or in the soil significantly affect soil formation. Plants furnish organic matter and transport plant nutrients from the underlying layers to the surface layer. As the plants die and decay, they contribute organic matter to the soil. Bacteria and fungi decompose the plant remains and help to incorporate the organic matter into the soil.

The kind of native vegetation has greatly affected soil formation in this county. In some areas the native vegetation was prairie grasses, and in other areas it was trees. Organic matter is added to soils that form under prairie grasses largely during the annual decomposition of the plant material. The tops of the plants decompose at the surface, but a large part of the plant material consists of roots, which decompose at various depths in the soil. Soils that formed under prairie grasses have a thick, dark surface layer. Higginsville, Macksburg, and Sibley soils are examples.

Organic matter is added to soils that form under forest vegetation mainly when leaves and twigs decompose on the surface. As a result, these soils have a thin, dark surface layer. Winfield, Weller, Knox, and Ladoga soils are examples.

The activities of living creatures, such as insects, worms, and animals, affect the soil. Bacteria and fungi cause the rotting of organic material, fix nitrogen, and improve tilth. Burrowing animals and insects loosen and mix various layers of the soil.

Human activities in this county have greatly affected soil formation in a relatively short time. The major effects of these activities have resulted from changes in vegetation, drainage, and accelerated erosion. Fields of row crops have replaced areas of native grasses and many forested areas. Nearly all of the flood plains and most of the areas on uplands are now farmed. The conversion to farmland has had some adverse affects on sustained productivity. Accelerated erosion continues to reduce the productivity of many soils on uplands. In some areas cropland has been lost to urban development.

Climate

Climate has been an important factor of soil formation in the county. Climatic variations in the past one million years have drastically affected conditions in the county.

Glacial periods resulted from changes in climate. Thousands of years of cooler temperatures caused the massive glaciers of the Nebraskan and Kansan ages. Later, warmer temperatures and high winds caused severe geologic erosion and the deposition of loess, which covered much of the county.

Native prairie grasses once were the dominant plants in the survey area. They thrived in a more arid climatic cycle than the current one. They influenced soil formation. Higginsville, Macksburg, Sibley, and other soils that formed under these grasses have a thick, dark surface layer.

High temperatures and adequate rainfall encourage rapid chemical and physical changes in the soil. These climatic factors are conducive to the breakdown of minerals and the relocation of clay within the soil. The clay is moved downward in the soil profile, forming a subsoil. Nearly all of the soils on uplands in the survey area show evidence of this relocation.

Relief

Relief refers to the lay of the land, or the general unevenness of the land surface. It influences soil formation through its effect on drainage, runoff, erosion, and exposure to sunlight and the wind. Slope influences the amount of runoff, the rate of water infiltration, the rate of leaching, the movement of clay, and the thickness of the solum.

In steep areas, runoff is rapid and very little water passes through the soil. As a result, soil formation is slow. Geologic erosion almost keeps pace with the soil-forming process. In gently sloping areas, runoff is slow, erosion is minimal, and most of the water passes through the soil. The infiltration of water intensifies leaching, the translocation of clay, and other soil-forming processes. The soils in these areas show maximum evidence of profile development.

In general, soils on south-facing slopes are droughtier than soils that formed in similar kinds of material on north-facing slopes. This difference results from more direct sunlight. The droughtiness influences soil formation through its effect on the amount and kind of vegetation growing on the soils, the rate of erosion, and the periods of freezing and thawing. Soil temperature also is directly related to the aspect and gradient of slopes.

Time

The age of a soil is indicated by the degree of profile development. It results from the interaction of the soil-forming processes over a period of time rather than from the length of time that the soil material has been in place. The older soils show the effects of leaching and clay movement and have distinct horizons. Young soils show little evidence of profile development.

The youngest soils in this survey are those that formed in alluvium. An example is Dockery soils, which are on flood plains and receive additions of alluvial material nearly every year. These soils show no evidence of profile development. In contrast, Bremer and Moniteau soils, which are on stream terraces and formed in older alluvium, have distinct horizons.

Snead soils, which are strongly sloping and moderately deep, formed in shale and limestone residuum that is much older than the other parent material in the survey area. They are considered young, however, because the removal of soil material through geologic erosion nearly keeps pace with the soil-forming processes.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

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:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

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.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

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

Clay 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 fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil 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.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

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.

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 the 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. The 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.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

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 human or animal activities 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.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

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.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

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.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the surface through pipes or nozzles from a pressure system.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

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).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

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, the slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range in moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

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.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer 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.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

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.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

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). The slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into 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.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05

Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of 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 sediments of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

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.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

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.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-86 at Marshall, Missouri)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	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-----	38.1	18.0	28.1	67	0	8	1.31	0.28	2.11	3	3.8
February----	43.5	23.5	33.5	71	0	11	1.50	.59	2.25	4	4.1
March-------	54.6	32.1	43.4	83	5	95	2.93	1.27	4.33	6	1.3
April-------	68.6	44.6	56.6	89	23	227	3.82	1.99	5.42	7	.3
May---------	77.6	54.6	66.1	92	36	499	4.37	2.77	5.81	7	.0
June--------	86.0	63.5	74.8	97	46	744	4.17	1.85	6.14	7	.0
July--------	91.1	67.8	79.5	103	53	915	4.00	1.64	5.98	6	.0
August------	89.0	65.1	77.1	101	51	840	2.90	1.10	4.40	5	.0
September---	81.6	57.5	69.6	96	39	588	4.10	1.18	6.44	5	.0
October-----	70.8	46.7	58.8	90	26	292	3.33	1.07	5.18	5	.0
November----	54.8	33.9	44.4	77	10	47	2.12	.46	3.45	3	.9
December----	42.5	24.1	33.3	67	10	11	1.58	.57	2.41	4	3.4
Yearly:											
Average---	66.5	44.3	55.4	---	---	---	---	---	---	---	---
Extreme---	---	---	---	104	10	---	---	---	---	---	---
Total-----	---	---	---	---	---	4,277	36.13	29.18	45.65	62	13.8

* 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

(Recorded in the period 1951-86 at Marshall, Missouri)

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--	Apr. 9	Apr. 20	Apr. 29
2 years in 10 later than--	Apr. 4	Apr. 15	Apr. 24
5 years in 10 later than--	Mar. 25	Apr. 5	Apr. 14
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 24	Oct. 18	Oct. 4
2 years in 10 earlier than--	Oct. 30	Oct. 23	Oct. 9
5 years in 10 earlier than--	Nov. 10	Nov. 1	Oct. 20

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-86 at Marshall, Missouri)

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	204	187	168
8 years in 10	213	195	175
5 years in 10	229	209	189
2 years in 10	245	224	202
1 year in 10	253	231	209

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
03	Aholt clay	3,205	0.7
04	Booker clay	1,420	0.3
05D2	Bluelick silt loam, 9 to 14 percent slopes, eroded	1,625	0.3
05E	Bluelick silt loam, 14 to 20 percent slopes	1,895	0.4
07D2	Newcomer silt loam, 9 to 14 percent slopes, eroded	530	0.1
07F	Newcomer silt loam, 14 to 35 percent slopes	905	0.2
09	Bremer silt loam	3,020	0.6
10A	Dameron silt loam, 0 to 3 percent slopes	1,965	0.4
11	Vesser silt loam	1,665	0.3
12	Colo silty clay loam	7,420	1.5
13	Grable very fine sandy loam, loamy substratum	2,650	0.5
14	Darwin silty clay	1,615	0.3
15	Dockery silt loam	25,650	5.2
18F	Moko-Rock outcrop complex, 9 to 45 percent slopes	510	0.1
21F	Goss cherty silt loam, 14 to 45 percent slopes	11,240	2.3
22C2	Greenton silt loam, 5 to 9 percent slopes, eroded	5,930	1.2
24	Haynie silt loam	8,750	1.8
26	Haynie-Waldron complex	5,720	1.2
30B	Higginsville silt loam, 2 to 5 percent slopes	26,600	5.4
30C2	Higginsville silt loam, 5 to 9 percent slopes, eroded	37,000	7.6
33C	Knox silt loam, 3 to 9 percent slopes	510	0.1
33C2	Knox silt loam, 3 to 9 percent slopes, eroded	7,050	1.4
33D2	Knox silt loam, 9 to 14 percent slopes, eroded	5,070	1.0
33F	Knox silt loam, 14 to 35 percent slopes	2,465	0.5
33F2	Knox silt loam, 14 to 35 percent slopes, eroded	790	0.2
36C2	Ladoga silt loam, 3 to 9 percent slopes, eroded	8,885	1.8
37A	Leslie silt loam, 0 to 2 percent slopes	1,050	0.2
37B	Leslie silt loam, 2 to 5 percent slopes	3,430	0.7
40	Leta silty clay	9,065	1.9
41	Levasy silty clay	3,400	0.7
42F	Plainfield loamy sand, 14 to 35 percent slopes	205	*
43B	Macksburg silt loam, 1 to 4 percent slopes	35,100	7.2
44C2	Arispe silt loam, 4 to 9 percent slopes, eroded	54,630	11.1
44D2	Arispe silt loam, 9 to 14 percent slopes, eroded	178	*
45C2	Mandeville silt loam, 5 to 9 percent slopes, eroded	495	0.1
45D2	Mandeville silt loam, 9 to 14 percent slopes, eroded	1,080	0.2
45F	Mandeville silt loam, 14 to 30 percent slopes	515	0.1
47B	Monona silt loam, 2 to 5 percent slopes	4,560	0.9
47C2	Monona silt loam, 5 to 9 percent slopes, eroded	1,000	0.2
50B	McGirk silt loam, 2 to 5 percent slopes	2,475	0.5
53C	Menfro silt loam, 3 to 9 percent slopes	470	0.1
53C2	Menfro silt loam, 3 to 9 percent slopes, eroded	9,365	1.9
53D2	Menfro silt loam, 9 to 14 percent slopes, eroded	4,425	0.9
53F	Menfro silt loam, 14 to 35 percent slopes	3,625	0.7
57	Joy silt loam	4,820	1.0
60	Moniteau silt loam	2,060	0.4
63	Nodaway silt loam	880	0.2
65	Ackmore silt loam	5,200	1.1
67C2	Sampsel silty clay loam, 5 to 9 percent slopes, eroded	490	0.1
68	Winterset silt loam	1,895	0.4
70A	Sarpy loamy fine sand, 0 to 4 percent slopes	1,445	0.3
73B	Sibley silt loam, 2 to 5 percent slopes	44,750	9.1
73C2	Sibley silt loam, 5 to 9 percent slopes, eroded	26,500	5.4
73D2	Sibley silt loam, 9 to 14 percent slopes, eroded	995	0.2
76D2	Snead silty clay loam, 9 to 14 percent slopes, eroded	430	0.1
83	Moville silt loam	2,990	0.6
86	Waldron silty clay	11,010	2.3
90B	Weller silt loam, 2 to 5 percent slopes	9,935	2.0
90C2	Weller silt loam, 5 to 9 percent slopes, eroded	36,950	7.5
90D2	Weller silt loam, 9 to 14 percent slopes, eroded	7,295	1.5
93C2	Winfield silt loam, 3 to 9 percent slopes, eroded	13,975	2.9

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
95	Wiota silt loam	280	0.1
96	Zook silty clay	1,020	0.2
99F	Lindley silt loam, 14 to 35 percent slopes	2,080	0.4
100	Pits, quarries	475	0.1
	Water areas more than 40 acres in size	6,310	1.3
	Total	490,938	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
03	Aholt clay (where drained)
04	Booker clay (where drained)
09	Bremer silt loam (where drained)
10A	Dameron silt loam, 0 to 3 percent slopes
11	Vesser silt loam (where drained)
12	Colo silty clay loam (where drained)
13	Grable very fine sandy loam, loamy substratum
14	Darwin silty clay (where drained)
15	Dockery silt loam (where protected from flooding or not frequently flooded during the growing season)
24	Haynie silt loam
26	Haynie-Waldron complex (where drained)
30B	Higginsville silt loam, 2 to 5 percent slopes
37A	Leslie silt loam, 0 to 2 percent slopes (where drained)
37B	Leslie silt loam, 2 to 5 percent slopes (where drained)
40	Leta silty clay
41	Levasy silty clay (where drained)
43B	Macksburg silt loam, 1 to 4 percent slopes
47B	Monona silt loam, 2 to 5 percent slopes
50B	McGirk silt loam, 2 to 5 percent slopes (where drained)
57	Joy silt loam
60	Moniteau silt loam (where drained)
63	Nodaway silt loam
65	Ackmore silt loam (where drained)
68	Winterset silt loam (where drained)
73B	Sibley silt loam, 2 to 5 percent slopes
83	Moville silt loam (where drained)
86	Waldron silty clay (where drained)
90B	Weller silt loam, 2 to 5 percent slopes
95	Wiota silt loam
96	Zook silty clay (where drained and either protected from flooding or not frequently flooded during the growing season)

TABLE 6.--LAND CAPABILITY 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	Grain sorghum	Winter wheat	Alfalfa hay	Orchard-grass-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
03------------- Aholt	IIIw	75	28	66	31	---	2.9	4.0
04------------- Booker	IIIw	75	28	66	31	---	2.9	4.0
05D2----------- Bluelick	IVe	81	30	71	33	2.8	3.0	4.5
05E------------ Bluelick	VIe	---	---	---	---	2.5	2.8	4.0
07D2----------- Newcomer	VIe	---	---	---	---	2.0	2.0	3.5
07F------------ Newcomer	VIe	---	---	---	---	---	1.5	2.5
09------------- Bremer	IIw	115	42	90	47	---	4.0	6.0
10A------------ Dameron	IIw	76	30	67	33	2.7	2.9	4.0
11------------- Vesser	IIw	105	38	90	42	---	3.8	6.0
12------------- Colo	IIw	112	40	96	45	---	4.0	6.3
13------------- Grable	IIs	101	37	88	41	3.6	3.8	6.1
14------------- Darwin	IIIw	95	35	84	39	---	3.5	6.0
15------------- Dockery	IIIw	105	38	90	31	---	3.8	6.1
18F**---------- Moko-Rock outcrop	VIIs	---	---	---	---	---	---	0.5
21F------------ Goss	VIIe	---	---	---	---	---	---	2.0
22C2----------- Greenton	IIIe	89	32	78	36	3.0	3.3	5.5
24------------- Haynie	I	117	43	102	48	4.1	4.3	7.0
26**----------- Haynie-Waldron	IIw	100	36	84	40	---	3.5	6.0
30B------------ Higginsville	IIe	126	47	106	51	4.0	4.5	7.5

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Alfalfa hay	Orchard-grass-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
30C2------------ Higginsville	IIIe	116	42	101	47	4.0	4.3	7.0
33C------------- Knox	IIIe	105	39	90	43	3.8	3.9	6.0
33C2------------ Knox	IIIe	100	37	85	38	3.5	3.5	5.5
33D2------------ Knox	IIIe	88	32	78	36	3.3	3.3	5.5
33F------------- Knox	VIe	---	---	---	---	---	---	4.0
33F2------------ Knox	VIe	---	---	---	---	---	---	4.0
36C2------------ Ladoga	IIIe	100	36	85	39	3.5	3.5	5.5
37A------------- Leslie	IIw	114	38	88	45	---	3.9	6.3
37B------------- Leslie	IIe	95	35	84	39	---	3.5	6.0
40-------------- Leta	IIw	95	35	83	39	---	3.5	6.0
41-------------- Levasy	IIIw	83	32	72	30	---	3.0	4.5
42F------------- Plainfield	VIIs	---	---	---	---	---	---	2.0
43B------------- Macksburg	IIe	114	41	96	46	---	4.0	6.3
44C2------------ Arispe	IIIe	110	40	95	43	---	4.0	6.2
44D2------------ Arispe	IVe	100	36	85	39	---	3.5	5.5
45C2------------ Mandeville	IVe	56	21	51	22	2.0	2.1	3.5
45D2------------ Mandeville	IVe	---	---	---	15	---	1.7	3.0
45F------------- Mandeville	VIe	---	---	---	---	---	---	2.5
47B------------- Monona	IIe	138	48	110	54	4.5	4.5	7.2
47C2------------ Monona	IIIe	133	45	105	50	4.3	4.3	6.8

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Alfalfa hay	Orchard-grass-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
50B-------------McGirk	IIe	83	28	72	32	---	3.0	4.5
53C-------------Menfro	IIIe	98	37	88	41	3.8	3.8	6.0
53C2------------Menfro	IIIe	94	35	83	38	3.5	3.5	5.5
53D2------------Menfro	IIIe	82	30	72	33	3.0	3.0	5.0
53F-------------Menfro	VIe	---	---	---	---	---	---	4.5
57--------------Joy	I	155	55	120	63	5.3	5.3	8.0
60--------------Moniteau	IIIw	90	31	80	35	---	3.3	5.5
63--------------Nodaway	IIw	110	41	95	46	4.0	4.0	6.2
65--------------Ackmore	IIw	108	40	94	44	---	4.0	6.1
67C2------------Sampsel	IIIe	78	28	69	31	---	3.0	5.0
68--------------Winterset	IIw	130	43	102	52	4.0	4.3	6.5
70A-------------Sarpy	IVs	---	---	---	20	2.0	2.0	3.0
73B-------------Sibley	IIe	118	44	104	48	4.3	4.3	7.0
73C2------------Sibley	IIIe	106	39	92	43	3.8	3.8	6.0
73D2------------Sibley	IIIe	100	36	85	39	3.5	3.5	5.5
76D2------------Snead	VIe	---	---	---	---	---	2.1	3.5
83--------------Moville	IIw	112	43	96	45	---	4.0	6.3
86--------------Waldron	IIw	86	30	74	37	---	3.2	4.5
90B-------------Weller	IIe	95	35	84	39	3.0	3.5	6.0
90C2------------Weller	IIIe	82	31	72	34	2.8	3.0	5.0

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Alfalfa hay	Orchard-grass-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
90D2------------ Weller	IVe	73	26	63	28	2.5	2.5	5.5
93C2------------ Winfield	IIIe	102	38	90	42	3.5	3.8	6.0
95-------------- Wiota	I	125	46	108	51	4.3	4.6	7.0
96-------------- Zook	Vw	---	---	---	---	---	2.6	5.0
99F------------- Lindley	VIIe	---	---	---	---	---	2.5	4.5
100**. Pits								

* 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	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
03-------------- Aholt	4W	Slight	Moderate	Severe	Severe	Pin oak-------------	80	62	Pin oak, green ash, eastern cottonwood.
						Eastern cottonwood--	90	103	
04-------------- Booker	6W	Slight	Severe	Severe	Severe	Eastern cottonwood--	85	91	Eastern cottonwood, pin oak, pecan, green ash, silver maple.
						Silver maple--------	80	34	
05D2------------ Bluelick	3A	Slight	Slight	Slight	Slight	White oak-----------	60	43	White ash, white oak, black walnut.
						Northern red oak----	65	48	
						Black oak-----------	62	45	
05E------------- Bluelick	3R	Moderate	Moderate	Slight	Slight	White oak-----------	60	43	White ash, white oak, black walnut.
						Northern red oak----	65	48	
						Black oak-----------	62	45	
07D2------------ Newcomer	3A	Slight	Slight	Slight	Slight	White oak-----------	60	43	White oak, white ash, yellow-poplar, sweetgum.
						Black walnut--------	---	---	
						Black oak-----------	---	---	
						Shagbark hickory----	---	---	
						White ash-----------	---	---	
07F------------- Newcomer	3R	Moderate	Moderate	Moderate	Slight	White oak-----------	60	43	White oak, white ash, yellow-poplar, sweetgum.
						Black walnut--------	---	---	
						Black oak-----------	---	---	
						Shagbark hickory----	---	---	
						White ash-----------	---	---	
09-------------- Bremer	7W	Slight	Severe	Moderate	Moderate	Eastern cottonwood--	90	103	Silver maple, eastern cottonwood, American sycamore, hackberry, green ash.
						Silver maple--------	80	34	
10A------------- Dameron	5A	Slight	Slight	Slight	Slight	Green ash-----------	70	33	Black walnut.
						Black walnut--------	72	---	
						American sycamore---	---	---	
						White oak-----------	---	---	
14-------------- Darwin	4W	Slight	Severe	Severe	Slight	Pin oak-------------	80	62	Eastern cottonwood, American sycamore, green ash, pin oak.
						Swamp white oak-----	---	---	
						Eastern cottonwood--	---	---	
						Green ash-----------	---	---	
						American sycamore---	---	---	
15-------------- Dockery	4A	Slight	Slight	Slight	Slight	Pin oak-------------	76	58	Pin oak, pecan, eastern cottonwood.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
18F**:									
Moko	2R	Moderate	Moderate	Moderate	Severe	Eastern redcedar	30	32	Eastern redcedar.
Rock outcrop.									
21F Goss	3R	Moderate	Moderate	Slight	Slight	White oak	60	43	Yellow-poplar, white ash.
						Post oak	---	---	
						Blackjack oak	---	---	
						Black oak	---	---	
24 Haynie	11A	Slight	Slight	Slight	Slight	Eastern cottonwood	110	156	Black walnut, eastern cottonwood.
						American sycamore	110	---	
						Black walnut	---	---	
						Green ash	---	---	
26**:									
Haynie	11A	Slight	Slight	Slight	Slight	Eastern cottonwood	110	156	Black walnut, eastern cottonwood.
						American sycamore	110	---	
						Black walnut	---	---	
						Green ash	---	---	
Waldron	11C	Slight	Moderate	Severe	Slight	Eastern cottonwood	110	156	Pin oak, pecan, eastern cottonwood, green ash, silver maple.
						Pin oak	80	62	
33C, 33C2, 33D2 Knox	4A	Slight	Slight	Slight	Slight	White oak	69	51	Eastern white pine, white ash, black walnut, yellow-poplar.
						Northern red oak	78	60	
33F, 33F2 Knox	4R	Moderate	Moderate	Moderate	Slight	White oak	69	51	Eastern white pine, white ash, black walnut, yellow-poplar.
						Northern red oak	78	60	
36C2 Ladoga	4A	Slight	Slight	Slight	Slight	White oak	75	57	Eastern white pine, white oak, sugar maple, northern red oak, black walnut.
						Northern red oak	75	57	
40 Leta	7W	Slight	Moderate	Severe	Severe	Eastern cottonwood	90	103	Pecan, eastern cottonwood, silver maple, green ash.
						Black willow	---	---	
41 Levasy	7W	Slight	Severe	Moderate	Moderate	Eastern cottonwood	90	103	Eastern cottonwood, pecan.
						Black willow	---	---	
42F Plainfield	3R	Moderate	Moderate	Moderate	Slight	White oak	55	38	Eastern white pine, northern red oak, black oak.
						Black oak	70	52	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
45C2, 45D2------ Mandeville	3A	Slight	Slight	Slight	Slight	White oak-----------	53	36	White oak, white ash, yellow-poplar.
						Northern red oak----	58	41	
						Black oak-----------	---	---	
						Shagbark hickory----	---	---	
						White ash-----------	---	---	
45F------------ Mandeville	3R	Moderate	Moderate	Moderate	Slight	White oak-----------	53	36	White oak, white ash, yellow-poplar.
						Black walnut--------	---	---	
						Black oak-----------	---	---	
50B------------ McGirk	3W	Slight	Severe	Moderate	Moderate	White oak-----------	55	38	White oak, pin oak, green ash, pecan, eastern cottonwood.
53C, 53C2, 53D2- Menfro	4A	Slight	Slight	Slight	Slight	Northern red oak----	81	63	White oak, sugar maple, shortleaf pine, white ash, black walnut, yellow-poplar. eastern white pine.
						Black oak-----------	73	55	
						White ash-----------	70	52	
						Sugar maple---------	68	50	
						White oak-----------	59	42	
53F------------ Menfro	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	81	63	White oak, sugar maple, shortleaf pine, white ash, black walnut, yellow-poplar, eastern white pine.
						Black oak-----------	73	55	
						White ash-----------	70	52	
						Sugar maple---------	68	50	
						White oak-----------	59	42	
60------------- Moniteau	4W	Slight	Severe	Moderate	Moderate	Pin oak-------------	70	52	White oak, pin oak, green ash, eastern cottonwood, silver maple.
63------------- Nodaway	3A	Slight	Slight	Slight	Slight	White oak-----------	65	48	Eastern white pine, black walnut, sugar maple.
65------------- Ackmore	3A	Slight	Slight	Slight	Slight	White oak-----------	65	48	Eastern white pine, cottonwood, sugar maple, black walnut.
70A------------ Sarpy	3S	Slight	Slight	Severe	Slight	Silver maple--------	90	42	Eastern cottonwood, American sycamore.
						Eastern cottonwood--	95	116	

See footnotes 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	Volume*	Trees to plant
76D2 Snead	3D	Slight	Slight	Severe	Severe	Northern red oak	64	45	White ash, northern red oak, yellow-poplar,
						White oak	48	38	
						White ash	63	56	
						Sugar maple	---	---	
86 Waldron	11C	Slight	Moderate	Severe	Slight	Eastern cottonwood	110	156	Pin oak, pecan, eastern cottonwood, green ash, silver maple.
						Pin oak	80	62	
90B, 90C2, 90D2 Weller	3C	Slight	Slight	Severe	Severe	White oak	55	38	Eastern white pine, black walnut, sugar maple.
93C2 Winfield	3A	Slight	Slight	Slight	Slight	White oak	65	48	Eastern white pine, white ash, yellow-poplar, northern red oak, black oak.
						Northern red oak	60	43	
						Black oak	65	48	
99F Lindley	3R	Moderate	Moderate	Slight	Slight	White oak	56	39	Northern red oak, black oak, white oak, eastern white pine.
						Northern red oak	61	44	
						Black oak	63	46	
						White oak	---	---	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** 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
03 Aholt	---	American plum, fragrant sumac, common chokecherry.	Manchurian crabapple, eastern redcedar, hackberry.	Austrian pine, Russian mulberry, green ash, golden willow, honeylocust.	Eastern cottonwood.
04 Booker	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Austrian pine, honeylocust, green ash, silver maple, golden willow, northern red oak.	Eastern cottonwood.
05D2, 05E Bluelick	---	Amur honeysuckle, Amur maple, autumn olive, lilac.	Eastern redcedar, hackberry, Russian olive.	Norway spruce, eastern white pine, pin oak, green ash, honeylocust.	---
07D2, 07F Newcomer	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive	Eastern redcedar, Austrian pine, hackberry, green ash, Russian olive.	Honeylocust, Siberian elm.	---
09 Bremer	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Austrian pine, honeylocust, green ash, silver maple, golden willow, northern red oak.	Eastern cottonwood.
10A Dameron	---	Amur honeysuckle, lilac, Amur maple, autumn olive.	Eastern redcedar	Austrian pine, hackberry, green ash, pin oak, honeylocust, eastern white pine.	Eastern cottonwood.
11 Vesser	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Honeylocust, green ash, northern red oak, Austrian pine, golden willow, silver maple.	Eastern cottonwood.
12 Colo	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Austrian pine, green ash, northern red oak, golden willow, honeylocust, silver maple, eastern cottonwood.	---

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
13. Grable	---	Siberian peashrub	Nannyberry viburnum, Washington hawthorn, white spruce, northern whitecedar, eastern redcedar, green ash.	Black willow, golden willow.	Eastern cottonwood, eastern cottonwood.
14. Darwin	---	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, Washington hawthorn, white fir.	Eastern white pine	Pin oak.
15. Dockery	---	Amur honeysuckle, lilac, autumn olive, Amur maple.	Eastern redcedar, pin oak.	Austrian pine, eastern white pine, honeylocust, hackberry, green ash.	Eastern cottonwood.
18F*: Moko.					
Rock outcrop.					
21F. Goss	Siberian peashrub	Lilac, Amur honeysuckle, autumn olive, eastern redcedar, Washington hawthorn, radiant crabapple.	Austrian pine, eastern white pine, red pine.	---	---
22C2. Greenton	Lilac	Amur honeysuckle, autumn olive, Manchurian crabapple, Siberian peashrub.	Eastern redcedar, Austrian pine, hackberry, green ash, Russian olive.	Honeylocust	---
24. Haynie	Blackhaw	Siberian peashrub	Washington hawthorn, Russian olive, Osageorange, eastern redcedar.	Bur oak, hackberry, green ash, honeylocust.	Eastern cottonwood.
26*: Haynie	Blackhaw	Siberian peashrub	Washington hawthorn, Russian olive, Osageorange, eastern redcedar.	Bur oak, hackberry, green ash, honeylocust.	Eastern cottonwood.

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
26*:					
Waldron	Blackhaw	Siberian peashrub	Eastern redcedar, Russian olive, Osageorange, Washington hawthorn.	Honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.
30B, 30C2 Higginsville	---	Amur honeysuckle, lilac, autumn olive, Amur maple.	Eastern redcedar	Austrian pine, eastern white pine, honeylocust, hackberry, green ash, pin oak.	Eastern cottonwood.
33C, 33C2, 33D2, 33F, 33F2 Knox	---	Amur honeysuckle, autumn olive, lilac, Amur maple.	Hackberry, eastern redcedar, green ash, bur oak, Russian olive.	Austrian pine, eastern white pine, honeylocust.	---
36C2 Ladoga	---	Lilac, Amur honeysuckle, autumn olive, Amur maple.	Eastern redcedar, hackberry, green ash, bur oak, Russian olive.	Austrian pine, eastern white pine, honeylocust.	---
37A, 37B Leslie	Lilac	Amur honeysuckle, autumn olive, Manchurian crabapple, Siberian peashrub.	Russian olive, Austrian pine, eastern redcedar, hackberry, green ash.	Honeylocust	---
40 Leta	Blackhaw	Siberian peashrub	Eastern redcedar, Osageorange, Russian olive, Washington hawthorn.	Honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.
41 Levasy	---	American plum, common chokecherry.	White spruce, Manchurian crabapple, hackberry, eastern redcedar.	Russian mulberry, Austrian pine, green ash, golden willow, honeylocust.	Eastern cottonwood.
42F Plainfield	Siberian peashrub	Radiant crabapple, Washington hawthorn, autumn olive, Amur honeysuckle, lilac.	Eastern redcedar, Austrian pine, jack pine.	Eastern cottonwood	---
43B Macksburg	---	Amur honeysuckle, lilac, autumn olive, Amur maple.	Eastern redcedar	Austrian pine, eastern white pine, honeylocust, hackberry, green ash, pin oak.	Eastern cottonwood.

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
44C2, 44D2 Arispe	---	Lilac, Amur honeysuckle, Amur maple, autumn olive.	Eastern redcedar, green ash, bur oak, Russian olive, hackberry.	Austrian pine, eastern white pine, honeylocust.	---
45C2, 45D2 Mandeville	Amur honeysuckle, lilac, fragrant sumac.	Gray dogwood	Eastern redcedar, Austrian pine, hackberry, green ash, Russian olive, bur oak.	Honeylocust, Siberian elm.	---
45F Mandeville	Amur honeysuckle, lilac, fragrant sumac.	---	Eastern redcedar, Austrian pine, hackberry, green ash, bur oak, Russian olive.	Honeylocust, Siberian elm.	---
47B, 47C2 Monona	---	Autumn olive, lilac, Amur maple, Amur honeysuckle.	Bur oak, hackberry, green ash, Russian olive, eastern redcedar.	Honeylocust, eastern white pine, Austrian pine.	---
50B McGirk	Lilac	Amur honeysuckle, autumn olive, Manchurian crabapple, Siberian peashrub.	Hackberry, Russian olive, Austrian pine, eastern redcedar, green ash.	Honeylocust	---
53C, 53C2, 53D2, 53F Menfro	---	Lilac, Amur honeysuckle, autumn olive, Amur maple.	Eastern redcedar, hackberry, green ash, bur oak, Russian olive.	Austrian pine, eastern white pine, honeylocust.	---
57 Joy	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
60 Moniteau	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Green ash, Austrian pine, silver maple, honeylocust, northern red oak, golden willow.	Eastern cottonwood.
63 Nodaway	---	Amur honeysuckle, autumn olive, Amur maple, lilac.	Eastern redcedar	Austrian pine, hackberry, honeylocust, green ash, eastern white pine, pin oak.	Eastern cottonwood.

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
65 Ackmore	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
67C2 Sampsel	Lilac	Amur honeysuckle, Siberian peashrub, gray dogwood, Manchurian crabapple.	Eastern redcedar, Russian olive, hackberry, red pine, Austrian pine, green ash.	Honeylocust	---
68 Winterset	---	American cranberrybush, Amur privet, silky dogwood, Amur honeysuckle.	Austrian pine, Washington hawthorn, blue spruce, northern whitecedar, white fir, Norway spruce.	Eastern white pine	Pin oak.
70A Sarpy	Blackhaw	Washington hawthorn, Siberian peashrub.	Eastern redcedar, Russian olive, Osageorange.	Honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.
73B, 73C2, 73D2 Sibley	---	Amur maple, Amur honeysuckle, lilac, autumn olive.	Green ash, eastern redcedar, hackberry, bur oak, Russian olive.	Eastern white pine, honeylocust, Austrian pine.	---
76D2 Snead	Lilac	Amur honeysuckle, Siberian peashrub, Manchurian crabapple.	Eastern redcedar, red pine, green ash, hackberry, Austrian pine.	Golden willow, honeylocust.	---
83 Moville	Blackhaw	Siberian peashrub	Washington hawthorn, Russian olive, Osageorange, eastern redcedar.	Bur oak, green ash, hackberry, honeylocust.	Eastern cottonwood.
86 Waldron	Blackhaw	Siberian peashrub	Eastern redcedar, Russian olive, Osageorange, Washington hawthorn.	Honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.
90B, 90C2, 90D2 Weller	Lilac	Manchurian crabapple, Amur honeysuckle, Siberian peashrub, autumn olive.	Eastern redcedar, Austrian pine, hackberry, green ash, Russian olive.	Honeylocust	---

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
93C2-------------- Winfield	---	Lilac, Amur honeysuckle, autumn olive, Amur maple.	Eastern redcedar, hackberry, green ash, bur oak, Russian olive.	Austrian pine, eastern white pine, honeylocust.	---
95---------------- Wiota	---	Lilac, Amur honeysuckle, autumn olive, Amur maple.	Eastern redcedar, hackberry, green ash, bur oak, Russian olive.	Austrian pine, eastern white pine, honeylocust.	---
96---------------- Zook	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Honeylocust, golden willow, green ash, northern red oak, silver maple, Austrian pine.	Eastern cottonwood.
99F--------------- Lindley	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Washington hawthorn, northern whitecedar, blue spruce, white fir.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
100*. Pits					

* 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
03-------------------- Aholt	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
04-------------------- Booker	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
05D2------------------ Bluelick	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
05E------------------- Bluelick	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
07D2------------------ Newcomer	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope, depth to rock.
07F------------------- Newcomer	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
09-------------------- Bremer	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
10A------------------- Dameron	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
11-------------------- Vesser	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
12-------------------- Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
13-------------------- Grable	Severe: flooding.	Slight----------	Slight----------	Slight----------	Slight.
14-------------------- Darwin	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
15-------------------- Dockery	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
18F*:					
Moko------------------	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: large stones, slope, small stones.	Severe: large stones, slope.	Severe: large stones, droughty, 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
18F*: Rock outcrop.					
21F-------------------- Goss	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: droughty, slope.
22C2------------------ Greenton	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
24-------------------- Haynie	Severe: flooding.	Slight	Slight	Slight	Slight.
26*:					
Haynie---------------	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Waldron--------------	Severe: flooding, wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
30B------------------- Higginsville	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Severe: erodes easily.	Moderate: wetness.
30C2------------------ Higginsville	Moderate: wetness.	Moderate: wetness.	Severe: slope.	Severe: erodes easily.	Moderate: wetness.
33C, 33C2------------- Knox	Slight	Slight	Severe: slope.	Slight	Slight.
33D2------------------ Knox	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
33F, 33F2------------- Knox	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
36C2------------------ Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
37A, 37B-------------- Leslie	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
40-------------------- Leta	Severe: flooding, wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
41-------------------- Levasy	Severe: flooding, ponding, too clayey.	Severe: ponding, too clayey.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
42F------------------- Plainfield	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.	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
43B------------------- Macksburg	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight----------	Slight.
44C2------------------ Arispe	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
44D2------------------ Arispe	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
45C2------------------ Mandeville	Moderate: wetness.	Moderate: wetness.	Severe: slope.	Slight----------	Moderate: thin layer, area reclaim.
45D2------------------ Mandeville	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer, area reclaim.
45F------------------- Mandeville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
47B------------------- Monona	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
47C2------------------ Monona	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
50B------------------- McGirk	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
53C, 53C2------------- Menfro	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
53D2------------------ Menfro	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
53F------------------- Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
57-------------------- Joy	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
60-------------------- Moniteau	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
63-------------------- Nodaway	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
65-------------------- Ackmore	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
67C2------------------ Sampsel	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness, erodes easily.	Severe: wetness.

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
68------------------- Winterset	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
70A------------------ Sarpy	Severe: flooding.	Slight----------	Slight----------	Slight----------	Moderate: droughty.
73B------------------ Sibley	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
73C2----------------- Sibley	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
73D2----------------- Sibley	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
76D2----------------- Snead	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Severe: erodes easily.	Moderate: large stones, slope.
83------------------- Moville	Severe: flooding, wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, flooding.
86------------------- Waldron	Severe: flooding, wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
90B------------------ Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.
90C2----------------- Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
90D2----------------- Weller	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
93C2----------------- Winfield	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
95------------------- Wiota	Severe: flooding.	Slight----------	Slight----------	Slight----------	Slight.
96------------------- Zook	Severe: flooding, wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness, flooding.	Severe: wetness, too clayey.	Severe: wetness, flooding, too clayey.
99F------------------ Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
100*. Pits					

* 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
03----------------- Aholt	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
04----------------- Booker	Poor	Poor	Fair	Poor	Poor	Poor	Good	Poor	Poor	Fair.
05D2--------------- Bluelick	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
05E---------------- Bluelick	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
07D2--------------- Newcomer	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
07F---------------- Newcomer	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
09----------------- Bremer	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
10A---------------- Dameron	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
11----------------- Vesser	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
12----------------- Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
13----------------- Grable	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
14----------------- Darwin	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Fair.
15----------------- Dockery	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
18F*:										
Moko--------------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.										
21F---------------- Goss	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
22C2--------------- Greenton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
24----------------- Haynie	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	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
26*:										
Haynie	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Waldron	Fair	Fair	Fair	Good	Good	Poor	Fair	Fair	Fair	Poor.
30B Higginsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
30C2 Higginsville	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
33C, 33C2, 33D2 Knox	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
33F, 33F2 Knox	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
36C2 Ladoga	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
37A, 37B Leslie	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
40 Leta	Fair	Fair	Poor	Good	Good	Poor	Fair	Fair	Fair	Poor.
41 Levasy	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
42F Plainfield	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
43B Macksburg	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
44C2, 44D2 Arispe	Good	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Very poor.
45C2, 45D2 Mandeville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
45F Mandeville	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
47B, 47C2 Monona	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
50B McGirk	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
53C, 53C2, 53D2 Menfro	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
53F Menfro	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
57 Joy	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
60----------------- Moniteau	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
63----------------- Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
65----------------- Ackmore	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
67C2--------------- Sampsel	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
68----------------- Winterset	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
70A---------------- Sarpy	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
73B---------------- Sibley	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
73C2, 73D2--------- Sibley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
76D2--------------- Snead	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
83----------------- Moville	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
86----------------- Waldron	Fair	Fair	Fair	Good	Good	Poor	Fair	Fair	Fair	Poor.
90B---------------- Weller	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
90C2, 90D2--------- Weller	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
93C2--------------- Winfield	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
95----------------- Wiota	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
96----------------- Zook	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
99F---------------- Lindley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
100*. Pits										

* 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
03 Aholt	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
04 Booker	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.
05D2 Bluelick	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
05E Bluelick	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
07D2 Newcomer	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope, depth to rock.
07F Newcomer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
09 Bremer	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Moderate: wetness, flooding.
10A Dameron	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
11 Vesser	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
12 Colo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
13 Grable	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
14 Darwin	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.
15 Dockery	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.	Severe: flooding.

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
18F*:						
Moko	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: large stones, droughty, slope.
Rock outcrop.						
21F Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
22C2 Greenton	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
24 Haynie	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
26*:						
Haynie	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
Waldron	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Severe: too clayey.
30B Higginsville	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: wetness.
30C2 Higginsville	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: wetness.
33C, 33C2 Knox	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
33D2 Knox	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
33F, 33F2 Knox	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
36C2 Ladoga	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: 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
37A, 37B----------Leslie	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
40----------------Leta	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Severe: too clayey.
41----------------Levasy	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.
42F---------------Plainfield	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
43B---------------Macksburg	Severe: wetness.	Severe: shrink-swell.	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
44C2--------------Arispe	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
44D2--------------Arispe	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, frost action.	Moderate: slope.
45C2--------------Mandeville	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: low strength, wetness.	Moderate: thin layer, area reclaim.
45D2--------------Mandeville	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Moderate: low strength, wetness, slope.	Moderate: slope, thin layer, area reclaim.
45F---------------Mandeville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
47B---------------Monona	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
47C2--------------Monona	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
50B---------------McGirk	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
53C, 53C2---------Menfro	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	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
53D2 Menfro	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
53F Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
57 Joy	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength, frost action.	Slight.
60 Moniteau	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
63 Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
65 Ackmore	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
67C2 Sampsel	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
68 Winterset	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
70A Sarpy	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.
73B Sibley	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
73C2 Sibley	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
73D2 Sibley	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
76D2 Snead	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: large stones, slope.
83 Moville	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, 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
86 Waldron	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Severe: too clayey.
90B, 90C2 Weller	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
90D2 Weller	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, frost action.	Moderate: slope.
93C2 Winfield	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
95 Wiota	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
96 Zook	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, flooding, too clayey.
99F Lindley	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
100*. Pits						

* 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
03------------------ Aholt	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
04------------------ Booker	Severe: flooding, ponding, percs slowly.	Slight-----------	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
05D2---------------- Bluelick	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, small stones.
05E----------------- Bluelick	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, small stones, slope.
07D2---------------- Newcomer	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
07F----------------- Newcomer	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
09------------------ Bremer	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
10A----------------- Dameron	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: small stones.
11------------------ Vesser	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
12------------------ Colo	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
13------------------ Grable	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
14------------------ Darwin	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
15------------------ Dockery	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.

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
18F*:					
Moko	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
Rock outcrop.					
21F Goss	Severe: slope.	Severe: seepage, slope.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, small stones, slope.
22C2 Greenton	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
24 Haynie	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
26*:					
Haynie	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
Waldron	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
30B Higginsville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
30C2 Higginsville	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
33C Knox	Slight	Severe: slope.	Slight	Slight	Good.
33C2 Knox	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
33D2 Knox	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
33F, 33F2 Knox	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
36C2 Ladoga	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
37A Leslie	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.

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
37B----------------- Leslie	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
40------------------ Leta	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
41------------------ Levasy	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.
42F----------------- Plainfield	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
43B----------------- Macksburg	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
44C2---------------- Arispe	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Poor: hard to pack.
44D2---------------- Arispe	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Poor: hard to pack.
45C2---------------- Mandeville	Severe: thin layer, seepage, wetness.	Severe: seepage, slope, wetness.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
45D2---------------- Mandeville	Severe: thin layer, seepage, wetness.	Severe: seepage, slope, wetness.	Severe: seepage.	Moderate: seepage, slope.	Poor: area reclaim, thin layer.
45F----------------- Mandeville	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
47B----------------- Monona	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
47C2---------------- Monona	Slight-----------	Severe: slope.	Slight-----------	Slight-----------	Good.
50B----------------- McGirk	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.

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
53C, 53C2----------- Menfro	Slight-----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
53D2---------------- Menfro	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
53F----------------- Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
57------------------ Joy	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
60------------------ Moniteau	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
63------------------ Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
65------------------ Ackmore	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
67C2---------------- Sampsel	Severe: wetness, percs slowly.	Severe: slope.	Severe: depth to rock, wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
68------------------ Winterset	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
70A----------------- Sarpy	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
73B----------------- Sibley	Slight-----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Poor: hard to pack.
73C2---------------- Sibley	Slight-----------	Severe: slope.	Moderate: too clayey.	Slight-----------	Poor: hard to pack.
73D2---------------- Sibley	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: hard to pack.
76D2---------------- Snead	Severe: thin layer, seepage.	Severe: seepage, slope, wetness.	Severe: seepage, too clayey.	Moderate: seepage, slope.	Poor: area reclaim, too clayey, hard to pack.
83------------------ Moville	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.

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
86------------------ Waldron	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
90B----------------- Weller	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
90C2---------------- Weller	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
90D2---------------- Weller	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
93C2---------------- Winfield	Severe: wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
95------------------ Wiota	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
96------------------ Zook	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
99F----------------- Lindley	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: wetness, slope.	Severe: wetness, slope.	Poor: slope.
100*. Pits					

* 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
03 Aholt	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
04 Booker	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
05D2 Bluelick	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
05E Bluelick	Fair: shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
07D2 Newcomer	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey, slope.
07F Newcomer	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
09 Bremer	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
10A Dameron	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
11 Vesser	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
12 Colo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
13 Grable	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
14 Darwin	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
15 Dockery	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
18F*:				
Moko	Poor: depth to rock, large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, large stones, slope.
Rock outcrop.				
21F Goss	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
22C2 Greenton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
24 Haynie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
26*:				
Haynie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Waldron	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
30B, 30C2 Higginsville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
33C, 33C2 Knox	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
33D2 Knox	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
33F, 33F2 Knox	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
36C2 Ladoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
37A, 37B Leslie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
40 Leta	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
41 Levasy	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
42F Plainfield	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
43B Macksburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
44C2, 44D2: Arispe	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
45C2, 45D2: Mandeville	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
45F: Mandeville	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
47B: Monona	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
47C2: Monona	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
50B: McGirk	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
53C, 53C2: Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
53D2: Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
53F: Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
57: Joy	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
60: Moniteau	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
63: Nodaway	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
65: Ackmore	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
67C2: Sampsel	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
68: Winterset	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
70A: Sarpy	Good.	Probable.	Improbable: too sandy.	Poor: too sandy.
73B, 73C2: Sibley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
73D2: Sibley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
76D2------------------ Snead	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, large stones.
83-------------------- Moville	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
86-------------------- Waldron	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
90B, 90C2, 90D2------- Weller	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
93C2------------------ Winfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
95-------------------- Wiota	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
96-------------------- Zook	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
99F------------------- Lindley	Fair: shrink-swell, wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
100*. Pits				

* 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--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
03-----------------Aholt	Slight---------	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
04-----------------Booker	Slight---------	Severe: hard to pack, ponding.	Ponding, percs slowly, flooding.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
05D2, 05E----------Bluelick	Severe: slope.	Slight---------	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
07D2, 07F----------Newcomer	Severe: slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
09-----------------Bremer	Slight---------	Severe: hard to pack, wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
10A----------------Dameron	Moderate: seepage.	Slight---------	Deep to water	Flooding-------	Favorable------	Favorable.
11-----------------Vesser	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
12-----------------Colo	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness--------	Wetness.
13-----------------Grable	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Erodes easily.
14-----------------Darwin	Slight---------	Severe: hard to pack, ponding.	Ponding, percs slowly.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
15-----------------Dockery	Moderate: seepage.	Moderate: piping, wetness.	Flooding, frost action.	Wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
18F*:						
Moko---------------	Severe: depth to rock, slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
21F----------------Goss	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
22C2---------------Greenton	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Wetness, 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	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
24 Haynie	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
26*:						
Haynie	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.
Waldron	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
30B, 30C2 Higginsville	Moderate: seepage, slope.	Moderate: wetness.	Frost action, slope.	Slope, wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
33C, 33C2 Knox	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
33D2, 33F, 33F2 Knox	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
36C2 Ladoga	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Slope	Erodes easily	Erodes easily.
37A Leslie	Slight	Moderate: hard to pack, wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
37B Leslie	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Wetness, erodes easily.
40 Leta	Moderate: seepage.	Severe: piping, wetness.	Percs slowly, flooding, frost action.	Wetness, slow intake, percs slowly.	Wetness	Wetness, percs slowly.
41 Levasy	Moderate: seepage.	Severe: piping, ponding.	Ponding, percs slowly, flooding.	Ponding, slow intake, percs slowly.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.
42F Plainfield	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
43B Macksburg	Moderate: seepage.	Moderate: wetness.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
44C2 Arispe	Moderate: seepage, slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
44D2 Arispe	Severe: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, percs slowly.
45C2 Mandeville	Moderate: seepage, slope.	Severe: thin layer.	Thin layer, slope.	Slope, wetness, thin layer.	Area reclaim, erodes easily.	Erodes easily, area reclaim.

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	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
45D2: Mandeville	Severe: slope.	Severe: thin layer.	Thin layer, slope.	Slope, wetness, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
45F: Mandeville	Severe: slope.	Severe: thin layer.	Deep to water	Slope, thin layer, erodes easily.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
47B, 47C2: Monona	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
50B: McGirk	Moderate: slope.	Severe: wetness, hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Wetness, erodes easily.
53C, 53C2: Menfro	Moderate: slope, seepage.	Slight	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
53D2, 53F: Menfro	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
57: Joy	Moderate: seepage.	Moderate: thin layer, piping, wetness.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
60: Moniteau	Slight	Severe: wetness.	Flooding, frost action.	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
63: Nodaway	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
65: Ackmore	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
67C2: Sampsel	Moderate: depth to rock, slope.	Severe: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
68: Winterset	Slight	Severe: wetness.	Frost action	Wetness	Erodes easily, wetness.	Wetness, erodes easily.
70A: Sarpy	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
73B, 73C2: Sibley	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope	Favorable	Favorable.
73D2: Sibley	Severe: slope.	Severe: hard to pack.	Deep to water	Slope	Slope	Slope.
76D2: Snead	Severe: slope.	Severe: thin layer.	Percs slowly, thin layer, slope.	Wetness, percs slowly.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
83 Moville	Moderate: seepage.	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
86 Waldron	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
90B, 90C2 Weller	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
90D2 Weller	Severe: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, percs slowly.
93C2 Winfield	Moderate: seepage, slope.	Moderate: thin layer, wetness.	Frost action, slope.	Slope, erodes easily.	Erodes easily, wetness.	Erodes easily.
95 Wiota	Moderate: seepage.	Slight	Deep to water	Favorable	Erodes easily	Erodes easily.
96 Zook	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
99F Lindley	Severe: slope.	Moderate: piping, wetness.	Slope	Wetness, slope.	Slope, wetness.	Slope.
100*. Pits						

* 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 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
03--------------- Aholt	0-17	Clay-------------	CH	A-7-6	0	100	100	95-100	90-100	60-80	35-55
	17-60	Clay, silty clay	CH	A-7-6	0	100	100	95-100	90-100	60-80	35-55
04--------------- Booker	0-16	Clay-------------	CL, CH	A-7	0	100	100	95-100	95-100	45-75	30-45
	16-60	Clay-------------	CH	A-7	0	100	100	100	95-100	65-85	40-55
05D2, 05E-------- Bluelick	0-5	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	5-13	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	13-28	Silty clay loam, silty clay.	CL	A-6, A-7	0	85-100	85-100	75-100	60-90	35-50	11-25
	28-60	Extremely cherty silty clay, very cherty clay, very cherty silty clay.	GC	A-2-7, A-7	0-10	30-50	25-50	25-45	20-40	50-70	25-45
07D2------------- Newcomer	0-7	Silt loam--------	CL	A-4, A-6	0	100	100	85-95	50-75	25-30	7-13
	7-15	Silt loam, loam, clay loam.	CL	A-4, A-6	0	85-100	75-100	75-100	45-80	22-40	9-22
	15-27	Loam, sandy clay loam, sandy loam.	CL-ML, CL	A-4, A-6	0	85-100	75-100	75-100	40-80	20-40	6-21
	27-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
07F-------------- Newcomer	0-7	Silt loam--------	CL	A-4, A-6	0	100	100	85-95	50-75	25-30	7-13
	7-15	Silt loam, loam, clay loam.	CL	A-4, A-6	0	85-100	75-100	75-100	45-80	22-40	9-22
	15-27	Loam, sandy clay loam, sandy loam.	CL-ML, CL	A-4, A-6	0	85-100	75-100	75-100	40-80	20-40	6-21
	27-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
09--------------- Bremer	0-22	Silt loam--------	CL, ML	A-6, A-7	0	100	100	100	95-100	35-45	10-20
	22-41	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-65	20-35
	41-60	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	40-60	25-40
10A-------------- Dameron	0-8	Silt loam--------	CL	A-6	0-1	95-100	90-100	85-100	80-95	25-40	10-20
	8-32	Silt loam, silty clay loam.	CL	A-6	0-1	95-100	90-100	85-100	80-95	25-40	10-20
	32-60	Very gravelly silty clay loam, gravelly silty clay loam.	GC, SC, CL	A-2-6, A-6	5-15	35-75	25-70	25-70	20-65	30-40	15-25
11--------------- Vesser	0-10	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	10-24	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	24-60	Silty clay loam	CL	A-7	0	100	100	98-100	95-100	40-50	15-25
12--------------- Colo	0-19	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	19-31	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	31-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
13--------------- Grable	0-9	Very fine sandy loam.	CL-ML, ML	A-4	0	100	100	80-95	80-95	<25	NP-5
	9-22	Very fine sandy loam, silt loam.	CL, CL-ML	A-4	0	100	100	80-95	80-95	20-30	5-10
	22-39	Loamy fine sand, fine sand.	SM, SP-SM, SC-SM	A-2, A-3	0	100	100	65-80	5-35	<20	NP-5
	39-60	Stratified loamy fine sand to silt loam.	CL, ML, SM, SC	A-4, A-2-4	0	100	100	70-90	25-70	20-30	NP-10
14--------------- Darwin	0-16	Silty clay-------	CH, CL	A-7	0	100	100	100	90-100	45-85	25-55
	16-40	Silty clay, clay	CH, CL	A-7	0	100	100	100	85-100	45-85	25-55
	40-60	Silty clay loam, silty clay.	CL, CH	A-7, A-6	0	100	100	95-100	90-100	35-70	20-45
15--------------- Dockery	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-35	5-15
	9-44	Silt loam, silty clay loam.	CL	A-4, A-6	0	100	100	90-100	85-95	25-40	8-20
	44-60	Stratified sandy loam to silt loam.	CL-ML, CL	A-4, A-6	0	100	100	65-95	35-85	25-35	5-12
18F*:											
Moko------------	0-12	Very flaggy silty clay loam.	CL, GC, SC	A-6, A-7	40-65	65-90	60-85	55-85	45-80	35-45	15-20
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
21F-------------- Goss	0-6	Cherty silt loam	ML, CL, CL-ML	A-4	0-10	65-85	65-75	65-75	65-75	20-30	2-10
	6-12	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	2-10
	12-60	Cherty silty clay loam, very cherty silty clay, very cherty clay.	GC, SC	A-7, A-2-7	10-45	45-70	20-65	20-50	20-45	50-70	30-40
22C2------------- Greenton	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	9-20	Silty clay loam, silty clay.	CH	A-7	0	100	100	95-100	95-100	50-70	35-45
	20-60	Silty clay, clay, channery silty clay.	CH	A-7	0-5	65-100	65-100	60-95	55-90	50-70	25-40
24--------------- Haynie	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	85-100	70-100	25-40	5-15
	9-60	Silt loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	85-100	85-100	25-35	5-15
26*:											
Haynie----------	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	85-100	70-100	25-40	5-15
	9-60	Silt loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	85-100	85-100	25-35	5-15

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 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
26*:											
Waldron	0-17	Silty clay	CL, CH	A-7	0	100	100	95-100	95-100	45-65	30-45
	17-60	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	100	95-100	90-100	40-65	20-45
30B Higginsville	0-19	Silt loam	CL	A-6	0	100	100	95-100	95-100	30-40	10-15
	19-28	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	28-48	Silty clay loam	CL	A-7	0	100	100	95-100	90-100	40-50	15-25
	48-60	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	90-100	35-45	10-20
30C2 Higginsville	0-12	Silt loam	CL	A-6	0	100	100	95-100	95-100	30-40	10-15
	12-20	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	20-44	Silty clay loam	CL	A-7	0	100	100	95-100	90-100	40-50	15-25
	44-60	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	90-100	35-45	10-20
33C, 33C2, 33D2, 33F Knox	0-8	Silt loam	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	90-100	20-35	2-15
	8-38	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	95-100	40-50	20-30
	38-60	Silt loam	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	10-25
33F2 Knox	0-7	Silt loam	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	90-100	20-35	2-15
	7-40	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	95-100	40-50	20-30
	40-60	Silt loam	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	10-25
36C2 Ladoga	0-8	Silt loam	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	8-36	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	36-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
37A, 37B Leslie	0-24	Silt loam	CL-ML, CL, ML	A-4	0	100	100	90-100	80-90	25-35	5-10
	24-30	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	85-95	35-50	10-25
	30-52	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	85-95	50-60	25-35
	52-60	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	100	100	95-100	85-95	35-50	10-25
40 Leta	0-13	Silty clay	CL, CH	A-7	0	100	100	95-100	95-100	45-65	30-45
	13-37	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	95-100	90-100	35-65	20-40
	37-60	Stratified silt loam to sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	80-100	51-95	20-35	5-15
41 Levasy	0-12	Silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-60	20-40
	12-36	Silty clay, silty clay loam, clay.	CH, CL	A-7	0	100	100	95-100	85-95	40-60	20-40
	36-60	Very fine sandy loam, silt loam, fine sandy loam.	CL, SC, CL-ML	A-6, A-4	0	100	100	70-95	40-75	20-40	4-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
42F-------------- Plainfield	0-4	Loamy sand-------	SM, SP-SM	A-2, A-4, A-1	0	75-100	75-100	40-90	12-40	---	NP
	4-52	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	40-70	1-15	---	NP
	52-60	Sand, fine sand	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	40-90	1-15	---	NP
43B-------------- Macksburg	0-15	Silt loam--------	CL	A-6, A-7	0	100	100	100	95-100	30-45	10-20
	15-33	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-60	20-35
	33-43	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
	43-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-50	20-30
44C2, 44D2------- Arispe	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-40	5-15
	6-19	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-60	25-35
	19-50	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	50-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
45C2, 45D2, 45F-- Mandeville	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	90-100	90-100	90-100	85-95	25-35	5-15
	6-11	Silty clay loam, silt loam, loam.	CL	A-6	0-5	80-90	80-90	70-85	65-80	30-40	11-20
	11-32	Channery silty clay loam, channery silt loam, channery loam.	CL	A-6	0-5	60-85	60-85	55-80	50-75	30-40	11-20
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
47B-------------- Monona	0-23	Silt loam--------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	23-46	Silt loam, silty clay loam.	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	46-60	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
47C2------------- Monona	0-23	Silt loam--------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	23-46	Silt loam, silty clay loam.	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	46-60	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
50B-------------- McGirk	0-16	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-40	5-15
	16-26	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	15-30
	26-48	Silty clay, silty clay loam.	CH, MH	A-7	0	100	100	95-100	90-100	50-75	25-40
	48-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	85-100	35-50	11-25
53C, 53C2, 53D2-- Menfro	0-8	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	25-35	11-20
	8-18	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	90-100	25-40	11-20
	18-60	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
53F-------------- Menfro	0-8	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	25-35	11-20
	8-18	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	90-100	25-40	11-20
	18-39	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
	39-60	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-35	5-15
57--------------- Joy	0-20	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-40	5-20
	20-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	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 Unified	Classification AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
60---------------Moniteau	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-35	5-15
	6-15	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-35	5-15
	15-60	Silty clay loam	CL	A-6, A-7	0	100	100	85-100	80-95	30-45	15-25
63---------------Nodaway	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-40	5-15
65---------------Ackmore	0-6	Silt loam--------	CL, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-50	8-20
	6-29	Silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-50	8-20
	29-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	95-100	85-100	35-60	15-30
67C2-------------Sampsel	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	10-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	97-100	95-100	52-75	35-47
68---------------Winterset	0-24	Silt loam--------	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	24-55	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	50-70	30-40
	55-60	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	25-35
70A--------------Sarpy	0-6	Loamy fine sand	SM	A-2-4	0	100	100	60-80	15-35	---	NP
	6-60	Fine sand, loamy fine sand, sand.	SM, SP, SP-SM	A-2-4, A-3	0	100	100	60-80	2-35	---	NP
73B--------------Sibley	0-18	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	30-40	10-20
	18-52	Silty clay loam	CL, CH, MH	A-7	0	100	100	95-100	90-100	40-55	20-35
	52-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-45	15-25
73C2, 73D2-------Sibley	0-9	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	30-40	10-20
	9-52	Silty clay loam	CL, CH, MH	A-7	0	100	100	95-100	90-100	40-55	20-35
	52-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-45	15-25
76D2-------------Snead	0-9	Silty clay loam	CL	A-6, A-7	0-10	90-100	90-100	90-100	80-95	35-45	15-25
	9-35	Silty clay, clay, channery clay.	CH, CL	A-7	0-10	65-100	65-100	60-100	55-100	45-60	25-40
	35-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
83---------------Moville	0-22	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	30-40	8-18
	22-60	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	65-85	40-60
86---------------Waldron	0-10	Silty clay-------	CL, CH	A-7	0	100	100	95-100	95-100	45-65	30-45
	10-60	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	100	95-100	90-100	40-65	20-45
90B--------------Weller	0-13	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	13-51	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-65	30-40
	51-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	100	95-100	30-55	10-30

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 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
90C2, 90D2: Weller	0-5	Silt loam	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	5-55	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-65	30-40
	55-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	100	95-100	30-55	10-30
93C2: Winfield	0-10	Silt loam	CL	A-6	0	100	100	95-100	90-100	25-40	10-20
	10-16	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-45	15-25
	16-47	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
	47-60	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-35	5-15
95: Wiota	0-20	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	100	90-95	25-35	5-15
	20-48	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	15-25
	48-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	95-100	90-95	30-50	15-30
96: Zook	0-26	Silty clay	CH	A-7	0	100	100	95-100	95-100	60-85	35-55
	26-60	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55
99F: Lindley	0-10	Silt loam	CL	A-6	0	95-100	90-100	85-95	50-65	25-35	10-15
	10-60	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	10-20
100*. Pits											

* 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" and "Organic matter" 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	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
03----------------	0-17	60-80	1.20-1.30	<0.06	0.11-0.13	6.6-8.4	Very high----	0.28	5	4	2-4
Aholt	17-60	50-80	1.20-1.30	<0.06	0.11-0.13	6.6-8.4	Very high----	0.28			
04----------------	0-16	40-70	1.30-1.50	<0.06	0.12-0.14	5.6-7.3	Very high----	0.28	5	4	1-3
Booker	16-60	60-75	1.30-1.45	<0.06	0.09-0.11	5.6-7.3	Very high----	0.28			
05D2, 05E--------	0-5	18-30	1.25-1.45	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	4	6	1-2
Bluelick	5-13	18-27	1.25-1.45	0.6-2.0	0.20-0.22	4.5-7.3	Low----------	0.43			
	13-28	35-45	1.20-1.40	0.2-0.6	0.10-0.18	4.5-6.0	Moderate-----	0.37			
	28-60	45-70	1.20-1.40	0.2-0.6	0.02-0.08	4.5-6.5	Moderate-----	0.20			
07D2--------------	0-7	15-23	1.30-1.45	0.6-2.0	0.16-0.24	5.6-7.8	Low----------	0.32	4	6	1-4
Newcomer	7-15	18-35	1.45-1.65	0.6-2.0	0.15-0.24	5.1-6.5	Moderate-----	0.32			
	15-27	12-35	1.45-1.65	0.6-2.0	0.10-0.22	5.1-7.3	Low----------	0.32			
	27-60	---	---	0.2-2.0	---	---	-------------	----			
07F---------------	0-7	15-23	1.30-1.45	0.6-2.0	0.16-0.24	5.6-7.8	Low----------	0.32	4	6	1-4
Newcomer	7-15	18-35	1.45-1.65	0.6-2.0	0.15-0.24	5.1-6.5	Moderate-----	0.32			
	15-27	12-35	1.45-1.65	0.6-2.0	0.10-0.22	5.1-7.3	Low----------	0.32			
	27-60	---	---	0.2-2.0	---	---	-------------	----			
09----------------	0-22	22-27	1.25-1.30	0.6-2.0	0.21-0.25	5.6-7.3	Moderate-----	0.32	5	6	2-4
Bremer	22-41	35-42	1.30-1.40	0.2-0.6	0.15-0.17	5.6-6.5	High---------	0.43			
	41-60	32-38	1.40-1.45	0.2-0.6	0.18-0.20	5.6-6.5	High---------	0.43			
10A---------------	0-8	20-27	1.25-1.40	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	4	6	2-4
Dameron	8-32	20-32	1.25-1.40	0.6-2.0	0.18-0.24	6.1-7.3	Moderate-----	0.32			
	32-60	27-32	1.20-1.55	0.6-2.0	0.04-0.10	5.6-7.3	Low----------	0.10			
11----------------	0-10	20-26	1.30-1.35	0.6-2.0	0.20-0.24	5.6-7.3	Moderate-----	0.28	5	6	2-3
Vesser	10-24	18-22	1.35-1.40	0.6-2.0	0.18-0.22	5.1-6.0	Moderate-----	0.43			
	24-60	30-35	1.40-1.45	0.6-2.0	0.17-0.21	5.1-6.5	Moderate-----	0.43			
12----------------	0-19	27-32	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7	3-4
Colo	19-31	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.28			
	31-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.28			
13----------------	0-9	15-20	1.20-1.30	0.6-2.0	0.22-0.24	7.4-8.4	Low----------	0.32	4	3	1-3
Grable	9-22	10-20	1.20-1.40	0.6-2.0	0.20-0.22	7.4-8.4	Low----------	0.43			
	22-39	5-10	1.20-1.40	6.0-20	0.04-0.08	7.4-8.4	Low----------	0.17			
	39-60	5-20	1.20-1.40	2.0-6.0	0.08-0.20	7.4-8.4	Low----------	0.32			
14----------------	0-16	40-45	1.20-1.40	<0.06	0.11-0.14	6.1-7.8	Very high----	0.28	5	4	2-4
Darwin	16-40	45-60	1.30-1.50	<0.06	0.11-0.14	6.1-7.8	Very high----	0.28			
	40-60	30-55	1.40-1.60	0.06-0.2	0.10-0.20	6.6-8.4	High---------	0.28			
15----------------	0-9	15-27	1.35-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	6	2-4
Dockery	9-44	18-30	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.8	Moderate-----	0.37			
	44-60	15-27	1.35-1.45	0.6-2.0	0.12-0.20	5.6-7.3	Moderate-----	0.37			
18F*:											
Moko-------------	0-12	27-35	1.25-1.50	0.6-2.0	0.08-0.14	6.6-7.8	Low----------	0.24	1	8	2-4
	12	---	---	0.00-0.2	---	---	-------------	----			
Rock outcrop.											

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	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
21F--------------- Goss	0-6	10-27	1.10-1.30	2.0-6.0	0.06-0.17	4.5-6.5	Low-----------	0.24	2	8	.5-2
	6-12	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low-----------	0.10			
	12-60	35-60	1.30-1.50	0.6-2.0	0.04-0.09	4.5-6.0	Moderate-----	0.10			
22C2------------- Greenton	0-9	20-27	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	3	6	2-4
	9-20	35-50	1.35-1.50	0.06-0.2	0.11-0.15	5.6-7.3	High----------	0.37			
	20-60	40-50	1.35-1.50	0.06-0.2	0.08-0.12	6.6-7.8	High----------	0.37			
24--------------- Haynie	0-9	15-25	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low-----------	0.37	5	4L	1-3
	9-60	15-18	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low-----------	0.37			
26*:											
Haynie----------	0-9	15-25	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low-----------	0.37	5	4L	1-3
	9-60	15-18	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low-----------	0.37			
Waldron---------	0-17	40-50	1.35-1.45	0.06-0.2	0.12-0.14	6.6-7.8	High----------	0.32	5	4	2-4
	17-60	35-50	1.45-1.60	0.06-0.2	0.10-0.18	7.4-8.4	High----------	0.32			
30B-------------- Higginsville	0-19	20-27	1.30-1.50	0.6-2.0	0.21-0.24	5.6-7.3	Low-----------	0.37	5	6	2-4
	19-28	27-35	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
	28-48	27-35	1.40-1.50	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
	48-60	25-30	1.50-1.60	0.6-2.0	0.18-0.22	5.1-6.5	Moderate-----	0.37			
30C2------------- Higginsville	0-12	20-27	1.30-1.50	0.6-2.0	0.21-0.24	5.6-7.3	Low-----------	0.37	5	6	2-4
	12-20	27-35	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
	20-44	27-35	1.40-1.50	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
	44-60	25-30	1.50-1.60	0.6-2.0	0.18-0.22	5.1-6.5	Moderate-----	0.37			
33C, 33C2, 33D2, 33F------------- Knox	0-8	18-27	1.20-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	6	1-3
	8-38	25-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
	38-60	18-27	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.43			
33F2------------- Knox	0-7	18-27	1.20-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	6	1-3
	7-40	25-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
	40-60	18-27	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.43			
36C2------------- Ladoga	0-8	18-27	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low-----------	0.32	5	6	2-3
	8-36	36-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	36-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
37A, 37B--------- Leslie	0-24	12-20	1.30-1.50	0.2-0.6	0.20-0.24	5.1-7.3	Low-----------	0.37	5	5	2-4
	24-30	20-35	1.30-1.50	0.2-0.6	0.18-0.22	5.1-6.0	Moderate-----	0.37			
	30-52	35-48	1.20-1.40	0.06-0.2	0.11-0.20	5.1-7.3	High----------	0.37			
	52-60	20-35	1.30-1.50	0.2-0.6	0.18-0.22	5.1-7.3	Moderate-----	0.37			
40--------------- Leta	0-13	40-48	1.30-1.50	0.06-0.2	0.12-0.14	6.6-7.8	High----------	0.28	5	4	2-4
	13-37	35-48	1.30-1.50	0.06-0.2	0.11-0.19	7.4-7.8	High----------	0.28			
	37-60	10-27	1.30-1.50	0.6-2.0	0.14-0.22	7.4-8.4	Low-----------	0.28			
41--------------- Levasy	0-12	40-60	1.25-1.40	0.06-0.2	0.12-0.20	7.4-8.4	High----------	0.28	5	4	2-4
	12-36	35-60	1.25-1.40	0.06-0.2	0.12-0.20	7.4-8.4	High----------	0.28			
	36-60	12-27	1.35-1.50	0.6-2.0	0.10-0.18	7.4-8.4	Low-----------	0.43			
42F-------------- Plainfield	0-4	3-7	1.50-1.65	2.0-6.0	0.09-0.12	4.5-7.3	Low-----------	0.17	5	2	<1
	4-52	0-4	1.50-1.65	6.0-20	0.04-0.07	4.5-7.3	Low-----------	0.17			
	52-60	0-4	1.50-1.70	6.0-20	0.04-0.07	4.5-6.5	Low-----------	0.17			

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	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
43B-------------- Macksburg	0-15	24-27	1.30-1.45	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	6	2-4
	15-33	36-42	1.35-1.40	0.2-0.6	0.18-0.20	5.1-6.0	High---------	0.43			
	33-43	30-38	1.40-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	43-60	25-32	1.40-1.45	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.43			
44C2, 44D2------- Arispe	0-6	25-27	1.35-1.40	0.6-2.0	0.21-0.23	5.6-7.3	Low----------	0.37	3	6	2-4
	6-19	38-42	1.35-1.45	0.2-0.6	0.18-0.20	5.6-7.3	High---------	0.43			
	19-50	30-38	1.35-1.45	0.2-0.6	0.18-0.20	5.6-7.3	High---------	0.43			
	50-60	24-35	1.40-1.50	0.6-2.0	0.18-0.20	5.6-7.3	High---------	0.43			
45C2, 45D2------- Mandeville	0-6	15-27	1.35-1.45	0.6-2.0	0.22-0.24	5.1-6.5	Low----------	0.37	4	6	1-2
	6-11	20-32	1.30-1.40	0.6-2.0	0.14-0.20	4.5-6.0	Low----------	0.37			
	11-32	20-32	1.30-1.40	0.6-2.0	0.12-0.18	4.5-6.0	Low----------	0.37			
	32-60	---	---	0.01-0.2	---	---	-------------	----			
45F-------------- Mandeville	0-6	15-27	1.35-1.45	0.6-2.0	0.22-0.24	5.1-6.5	Low----------	0.37	4	6	1-2
	6-11	20-32	1.30-1.40	0.6-2.0	0.14-0.20	4.5-6.0	Low----------	0.37			
	11-32	20-32	1.30-1.40	0.6-2.0	0.12-0.18	4.5-6.0	Low----------	0.37			
	32-60	---	---	0.01-0.06	---	---	-------------	----			
47B-------------- Monona	0-23	20-27	1.25-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.28	5	6	3-4
	23-46	24-28	1.30-1.35	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.43			
	46-60	18-24	1.35-1.40	0.6-2.0	0.20-0.22	6.6-8.4	Low----------	0.43			
47C2------------- Monona	0-23	20-27	1.25-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.32	5	6	2-3
	23-46	24-28	1.30-1.35	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.43			
	46-60	18-24	1.35-1.40	0.6-2.0	0.20-0.22	6.6-8.4	Low----------	0.43			
50B-------------- McGirk	0-16	15-27	1.30-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.43	3	6	1-2
	16-26	27-40	1.30-1.40	0.2-0.6	0.18-0.20	4.5-6.5	Moderate-----	0.43			
	26-48	35-50	1.25-1.35	0.06-0.2	0.10-0.18	4.5-6.0	High---------	0.32			
	48-60	20-35	1.30-1.40	0.2-0.6	0.14-0.18	4.5-6.0	Moderate-----	0.37			
53C, 53C2, 53D2-- Menfro	0-8	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	.5-2
	8-18	25-30	1.30-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.37			
	18-60	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
53F-------------- Menfro	0-8	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	.5-2
	8-18	25-30	1.30-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.37			
	18-39	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	39-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
57--------------- Joy	0-20	15-25	1.10-1.20	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.28	5	6	2-4
	20-60	18-27	1.15-1.25	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.43			
60--------------- Moniteau	0-6	18-27	1.20-1.40	0.6-2.0	0.21-0.23	6.1-7.3	Low----------	0.43	5	6	1-2
	6-15	18-27	1.20-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.43			
	15-60	27-35	1.30-1.50	0.2-0.6	0.18-0.20	4.5-6.0	Moderate-----	0.43			
63--------------- Nodaway	0-8	18-27	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Low----------	0.32	5	6	2-3
	8-60	18-28	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate-----	0.43			
65--------------- Ackmore	0-6	18-27	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	6	2-4
	6-29	18-30	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32			
	29-60	26-38	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.8	High---------	0.32			
67C2------------- Sampsel	0-10	27-35	1.30-1.50	0.2-0.6	0.21-0.24	5.6-7.3	Moderate-----	0.37	3	7	3-4
	10-60	35-60	1.40-1.60	0.06-0.2	0.11-0.13	5.6-7.8	High---------	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	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
68---------------Winterset	0-24	26-27	1.30-1.35	0.2-0.6	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	6	4-6
	24-55	38-42	1.35-1.40	0.2-0.6	0.14-0.18	5.6-6.5	High---------	0.43			
	55-60	27-40	1.40-1.45	0.2-0.6	0.18-0.20	6.1-7.3	Moderate-----	0.43			
70A--------------Sarpy	0-6	2-5	1.20-1.50	>6.0	0.05-0.09	6.6-8.4	Low----------	0.17	5	2	<1
	6-60	2-5	1.20-1.50	>6.0	0.05-0.09	6.6-8.4	Low----------	0.15			
73B--------------Sibley	0-18	20-27	1.20-1.50	0.6-2.0	0.19-0.21	5.6-7.8	Moderate-----	0.28	5	6	3-4
	18-52	28-38	1.30-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28			
	52-60	20-30	1.20-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.43			
73C2, 73D2-------Sibley	0-9	20-27	1.20-1.50	0.6-2.0	0.19-0.21	5.6-7.8	Moderate-----	0.28	5	6	3-4
	9-52	28-38	1.30-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28			
	52-60	20-30	1.20-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.43			
76D2-------------Snead	0-9	27-40	1.30-1.40	0.2-0.6	0.21-0.24	6.1-7.3	Moderate-----	0.37	3	7	2-4
	9-35	40-60	1.25-1.35	0.06-0.2	0.12-0.14	6.6-8.4	High---------	0.32			
	35-60	---	---	0.01-0.2	---	---	-------------	----			
83---------------Moville	0-22	10-18	1.25-1.30	0.6-2.0	0.21-0.23	7.4-8.4	Low----------	0.37	4	4L	1-3
	22-60	50-60	1.35-1.45	<0.06	0.11-0.13	6.6-7.8	High---------	0.28			
86---------------Waldron	0-10	40-50	1.35-1.45	0.06-0.2	0.12-0.14	6.6-7.8	High---------	0.32	5	4	2-4
	10-60	35-50	1.45-1.60	0.06-0.2	0.10-0.18	7.4-8.4	High---------	0.32			
90B--------------Weller	0-13	16-27	1.35-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.37	3	6	2-3
	13-51	28-48	1.35-1.50	0.06-0.2	0.12-0.18	4.5-6.0	High---------	0.43			
	51-60	25-40	1.40-1.55	0.2-0.6	0.18-0.20	5.1-6.0	High---------	0.43			
90C2, 90D2-------Weller	0-5	16-27	1.35-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.37	3	6	1-2
	5-55	28-48	1.35-1.50	0.06-0.2	0.12-0.18	4.5-6.0	High---------	0.43			
	55-60	25-40	1.40-1.55	0.2-0.6	0.18-0.20	5.1-6.0	High---------	0.43			
93C2-------------Winfield	0-10	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	6	.5-2
	10-16	25-30	1.30-1.50	0.6-2.0	0.18-0.22	5.6-7.3	Moderate-----	0.37			
	16-47	27-35	1.30-1.50	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37			
	47-60	20-27	1.30-1.50	0.6-2.0	0.20-0.22	5.1-6.0	Low----------	0.37			
95---------------Wiota	0-20	20-27	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Low----------	0.28	5	6	3-4
	20-48	30-36	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	48-60	25-34	1.40-1.45	0.6-2.0	0.18-0.20	6.1-6.5	Moderate-----	0.43			
96---------------Zook	0-26	40-44	1.35-1.40	0.06-0.2	0.11-0.13	5.6-7.3	High---------	0.28	5	4	3-5
	26-60	36-45	1.30-1.45	0.06-0.2	0.11-0.13	5.6-7.8	High---------	0.28			
99F--------------Lindley	0-10	18-27	1.20-1.40	0.6-2.0	0.16-0.18	4.5-7.3	Low----------	0.32	5	6	1-2
	10-60	25-35	1.35-1.55	0.2-0.6	0.14-0.18	4.5-6.5	Moderate-----	0.32			
100*. Pits											

* 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	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
03 Aholt	D	Occasional	Brief to long.	Nov-May	0-1.0	Apparent	Nov-May	>60	---	Moderate	High	Low.
04 Booker	D	Occasional	Brief to long.	Nov-May	+.5-1.0	Apparent	Nov-May	>60	---	Moderate	High	Moderate.
05D2, 05E Bluelick	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	High.
07D2, 07F Newcomer	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low	Moderate.
09 Bremer	C	Occasional	Very brief	Nov-May	1.0-2.0	Apparent	Nov-May	>60	---	High	Moderate	Moderate.
10A Dameron	B	Occasional	Very brief	Nov-May	>6.0	---	---	>60	---	Moderate	Low	Low.
11 Vesser	C	Occasional	Brief	Nov-May	1.0-3.0	Apparent	Nov-May	>60	---	High	High	Moderate.
12 Colo	B/D	Occasional	Brief	Nov-May	1.0-3.0	Apparent	Nov-May	>60	---	High	High	Moderate.
13 Grable	B	Rare	---	---	>6.0	---	---	>60	---	Low	Low	Low.
14 Darwin	D	Rare	---	---	+1-2.0	Apparent	Jan-May	>60	---	Moderate	High	Low.
15 Dockery	C	Frequent	Brief	Nov-May	2.0-3.0	Apparent	Nov-May	>60	---	High	Moderate	Low.
18F*:												
Moko	D	None	---	---	>6.0	---	---	6-20	Hard	---	Low	Low.
Rock outcrop.												
21F Goss	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	Hydrologic 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				
22C2--------------- Greenton	C	None---------	---	---	1.5-3.0	Perched	Nov-May	>60	---	Moderate	High-----	Moderate.
24----------------- Haynie	B	Rare---------	---	---	3.0-6.0	Apparent	Nov-May	>60	---	High-----	Low------	Low.
26*:												
Haynie------------	B	Occasional	Brief to long.	Nov-Jun	3.0-6.0	Apparent	Nov-May	>60	---	High-----	Low------	Low.
Waldron-----------	D	Occasional	Brief to long.	Nov-Jun	1.0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
30B, 30C2--------- Higginsville	C	None---------	---	---	1.5-3.0	Perched	Nov-May	>60	---	High-----	Moderate	Moderate.
33C, 33C2, 33D2, 33F, 33F2-------- Knox	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Low.
36C2--------------- Ladoga	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
37A, 37B----------- Leslie	D	None---------	---	---	1.0-2.0	Perched	Nov-May	>60	---	High-----	High-----	Moderate.
40----------------- Leta	C	Occasional	Brief to long.	Nov-Jun	1.0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
41----------------- Levasy	C	Occasional	Brief to long.	Nov-Jun	+1-1.5	Apparent	Nov-May	>60	---	High-----	High-----	Low.
42F---------------- Plainfield	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	High.
43B---------------- Macksburg	B	None---------	---	---	2.0-4.0	Perched	Nov-May	>60	---	High-----	High-----	Moderate.
44C2, 44D2-------- Arispe	C	None---------	---	---	2.0-4.0	Perched	Nov-May	>60	---	High-----	High-----	Moderate.
45C2, 45D2-------- Mandeville	B	None---------	---	---	2.0-3.0	Perched	Nov-May	20-40	Soft	Moderate	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				
45F----------------- Mandeville	B	None---------	---	---	>6.0	---	---	20-40	Soft	Moderate	Low-------	Moderate.
47B, 47C2---------- Monona	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low-------	Low.
50B----------------- McGirk	C	None---------	---	---	0.5-2.0	Perched	Nov-May	>60	---	High-----	High-----	High.
53C, 53C2, 53D2, 53F---------------- Menfro	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low-------	Moderate.
57------------------ Joy	B	None---------	---	---	2.0-4.0	Perched	Nov-May	>60	---	High-----	High-----	Moderate.
60------------------ Moniteau	C/D	Occasional	Brief-----	Nov-May	0-1.0	Apparent	Nov-May	>60	---	High-----	High-----	High.
63------------------ Nodaway	B	Occasional	Very brief to brief.	Nov-May	3.0-5.0	Apparent	Nov-May	>60	---	High-----	Moderate	Low.
65------------------ Ackmore	B	Occasional	Very brief to brief.	Nov-May	1.0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
67C2---------------- Sampsel	D	None---------	---	---	0-1.5	Perched	Nov-May	40-60	Soft	High-----	High-----	Low.
68------------------ Winterset	C	None---------	---	---	1.0-2.0	Perched	Nov-May	>60	---	High-----	High-----	Moderate.
70A----------------- Sarpy	A	Rare---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	Low.
73B, 73C2, 73D2---- Sibley	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low-------	Moderate.
76D2---------------- Snead	D	None---------	---	---	2.0-3.0	Perched	Nov-Mar	20-40	Soft	Moderate	High-----	Low.
83------------------ Moville	C	Occasional	Brief to long.	Nov-May	1.0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic 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				
86---------------- Waldron	D	Occasional	Brief to long.	Nov-May	1.0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
90B, 90C2, 90D2--- Weller	C	None--------	---	---	2.0-4.0	Perched	Nov-May	>60	---	High-----	High-----	High.
93C2-------------- Winfield	B	None--------	---	---	2.5-4.0	Perched	Nov-Apr	>60	---	High-----	Moderate	Moderate.
95---------------- Wiota	B	Rare--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
96---------------- Zook	C/D	Frequent----	Brief to long.	Nov-May	0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
99F--------------- Lindley	C	None--------	---	---	2.0-3.5	Perched	Nov-Apr	>60	---	Moderate	Moderate	Moderate.
100*. Pits												

* 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
Ackmore	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Aholt	Very fine, montmorillonitic (calcareous), mesic Vertic Haplaquolls
*Arispe	Fine, montmorillonitic, mesic Aquic Argiudolls
Bluelick	Fine, mixed, mesic Typic Paleudalfs
Booker	Very fine, montmorillonitic, mesic Vertic Haplaquolls
Bremer	Fine, montmorillonitic, mesic Typic Argiaquolls
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Dameron	Fine-loamy, mixed, mesic Cumulic Hapludolls
Darwin	Fine, montmorillonitic, mesic Vertic Haplaquolls
Dockery	Fine-silty, mixed, nonacid, mesic Aquic Udifluvents
Goss	Clayey-skeletal, mixed, mesic Typic Paleudalfs
Grable	Coarse-silty over sandy or sandy-skeletal, mixed (calcareous), mesic Mollic Udifluvents
*Greenton	Fine, montmorillonitic, mesic Aquic Argiudolls
Haynie	Coarse-silty, mixed (calcareous), mesic Mollic Udifluvents
Higginsville	Fine-silty, mixed, mesic Aquic Argiudolls
Joy	Fine-silty, mixed, mesic Aquic Hapludolls
Knox	Fine-silty, mixed, mesic Mollic Hapludalfs
Ladoga	Fine, montmorillonitic, mesic Mollic Hapludalfs
Leslie	Fine, montmorillonitic, mesic Argiaquic Argialbolls
Leta	Clayey over loamy, montmorillonitic, mesic Fluvaquentic Hapludolls
Levasy	Clayey over loamy, montmorillonitic (calcareous), mesic Fluvaquentic Haplaquolls
Lindley	Fine-loamy, mixed, mesic Typic Hapludalfs
Macksburg	Fine, montmorillonitic, mesic Aquic Argiudolls
Mandeville	Fine-loamy, mixed, mesic Typic Hapludalfs
McGirk	Fine, montmorillonitic, mesic, sloping Typic Ochraqualfs
Menfro	Fine-silty, mixed, mesic Typic Hapludalfs
Moko	Loamy-skeletal, mixed, mesic Lithic Hapludolls
Moniteau	Fine-silty, mixed, mesic Typic Ochraqualfs
Monona	Fine-silty, mixed, mesic Typic Hapludolls
Moville	Coarse-silty over clayey, mixed (calcareous), mesic Aeric Fluvaquents
Newcomer	Fine-loamy, mixed, mesic Mollic Hapludalfs
Nodaway	Fine-silty, mixed, nonacid, mesic Mollic Udifluvents
Plainfield	Mixed, mesic Typic Udipsamments
Sampsel	Fine, montmorillonitic, mesic, sloping Typic Argiaquolls
Sarpy	Mixed, mesic Typic Udipsamments
Sibley	Fine-silty, mixed, mesic Typic Argiudolls
*Snead	Fine, mixed, mesic Aquic Hapludolls
Vesser	Fine-silty, mixed, mesic Argiaquic Argialbolls
Waldron	Fine, montmorillonitic (calcareous), mesic Aeric Fluvaquents
Weller	Fine, montmorillonitic, mesic Aquic Hapludalfs
Winfield	Fine-silty, mixed, mesic Typic Hapludalfs
Winterset	Fine, montmorillonitic, mesic Typic Argiaquolls
Wiota	Fine-silty, mixed, mesic Typic Argiudolls
Zook	Fine, montmorillonitic, mesic Cumulic Haplaquolls

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