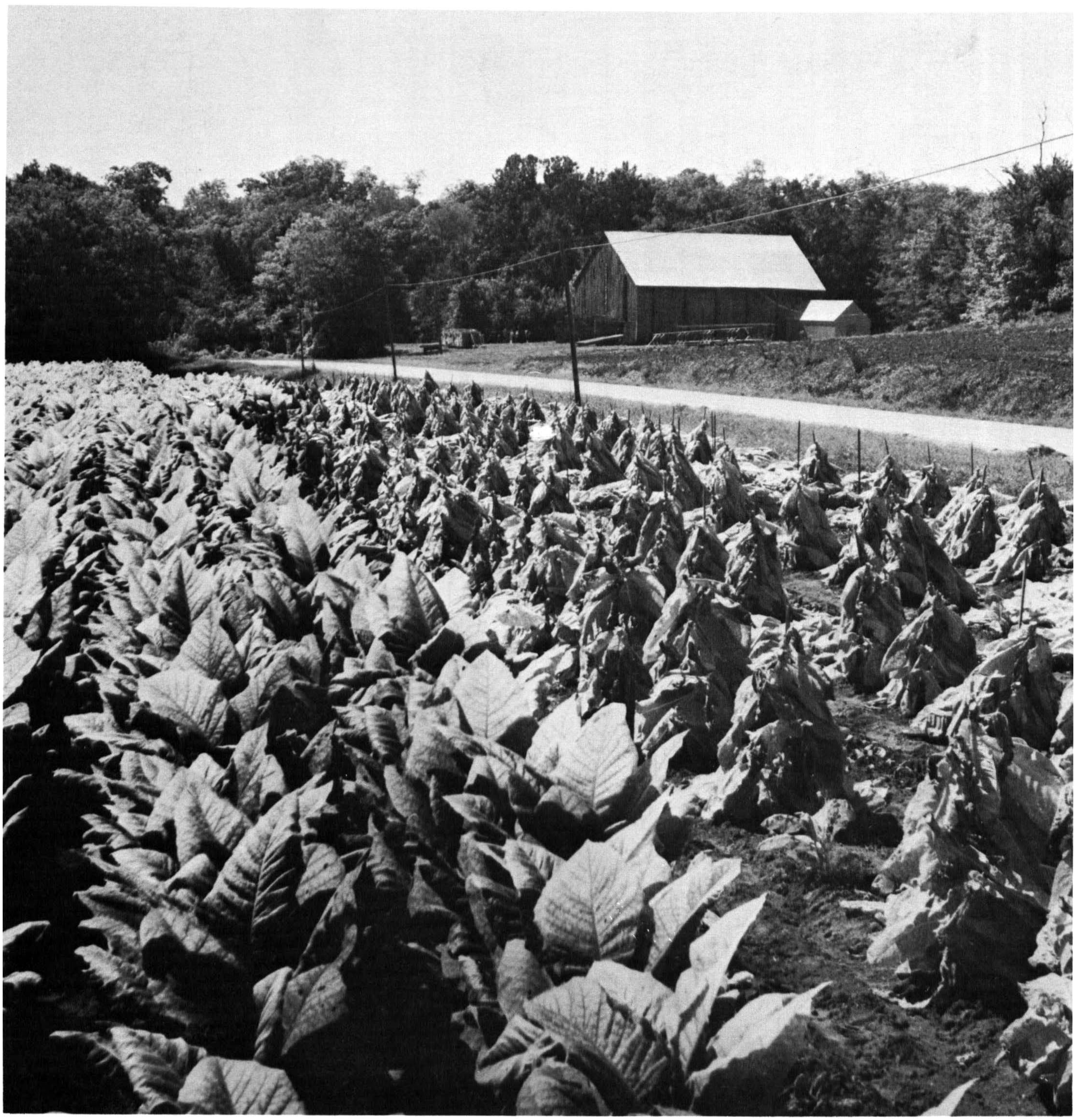
United States
Department of
Agriculture

Soil
Conservation
Service

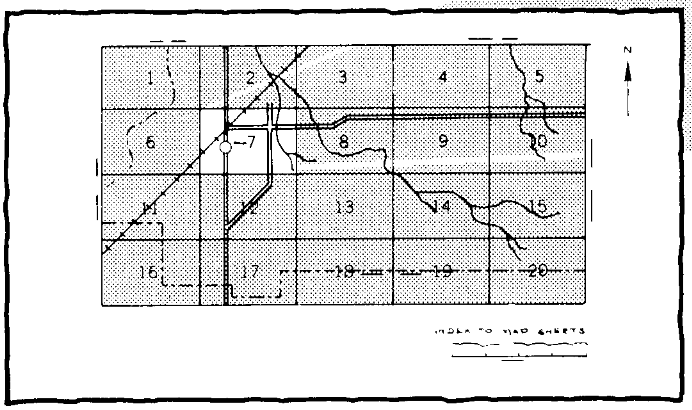
In cooperation with
Missouri Agricultural
Experiment Station

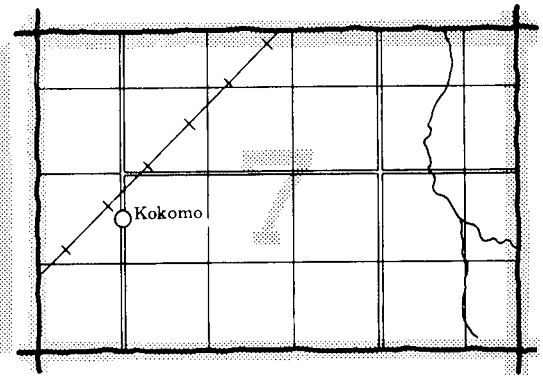
Soil Survey of Platte County Missouri



HOW TO USE

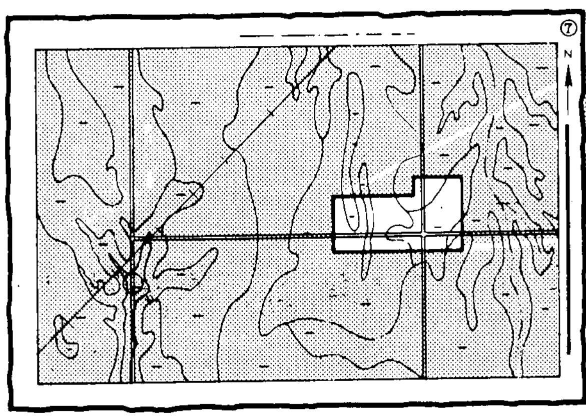
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

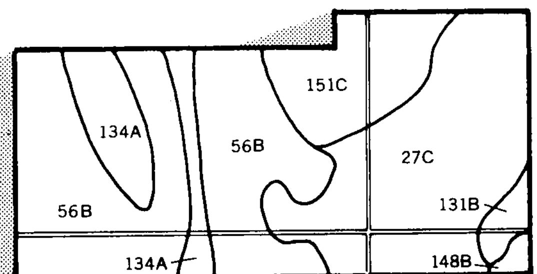




2. Note the number of the map sheet and turn to that sheet.

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





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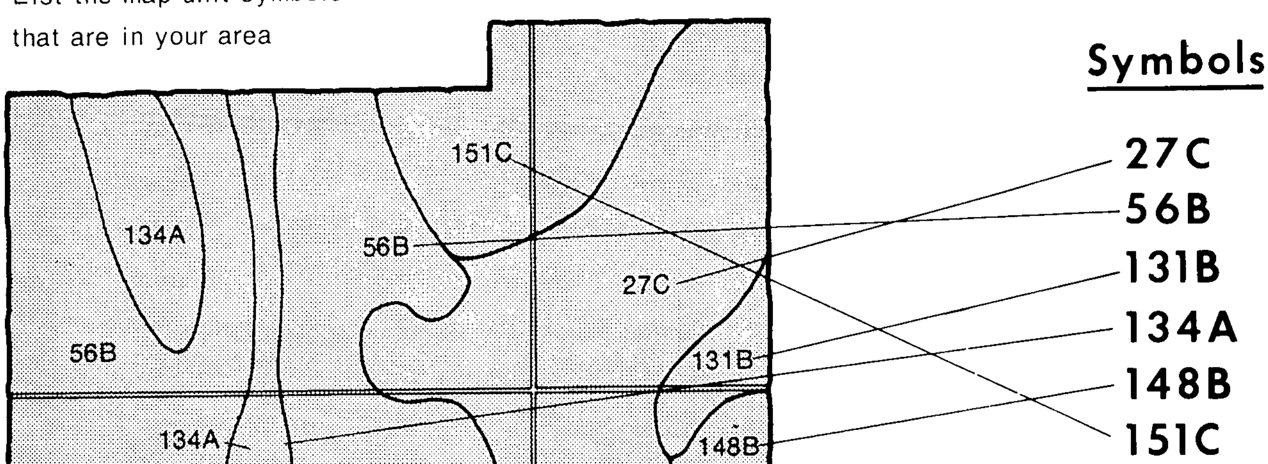
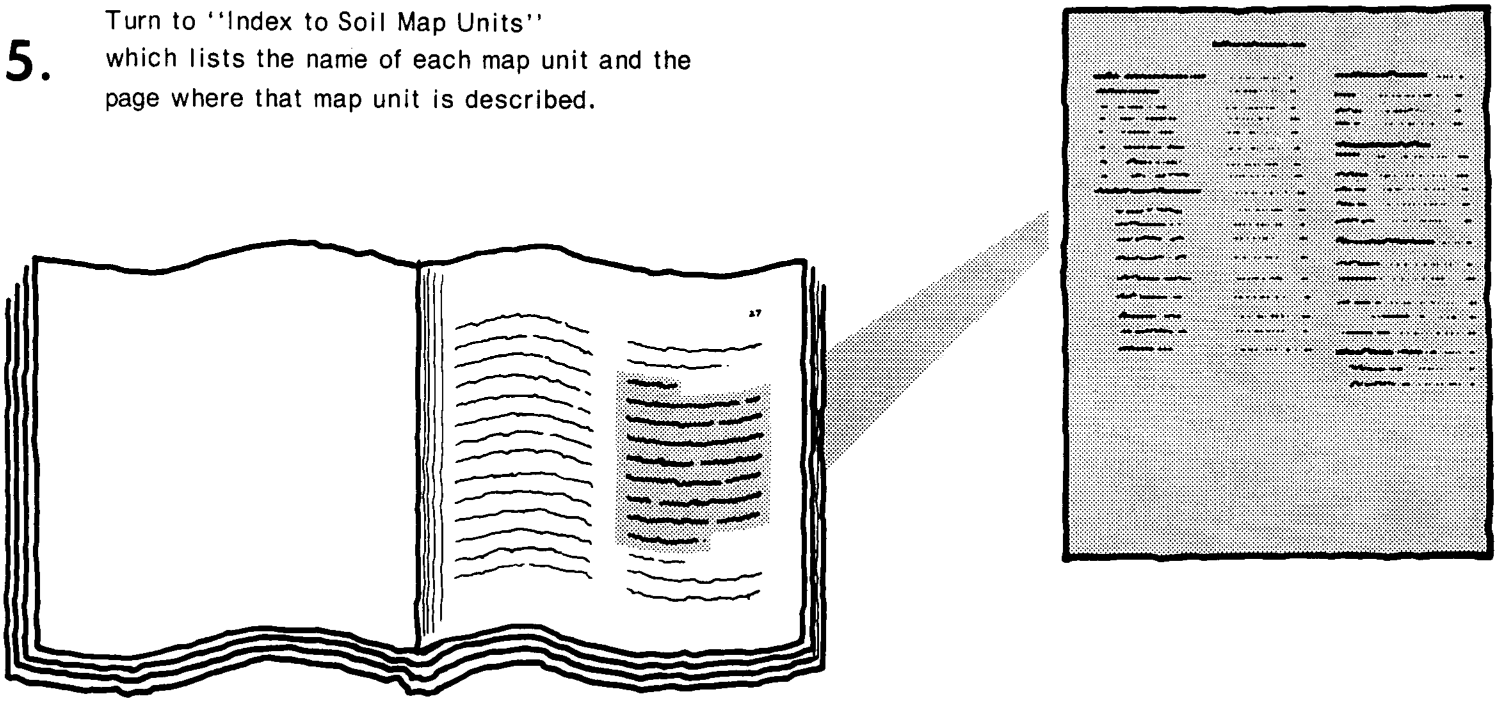
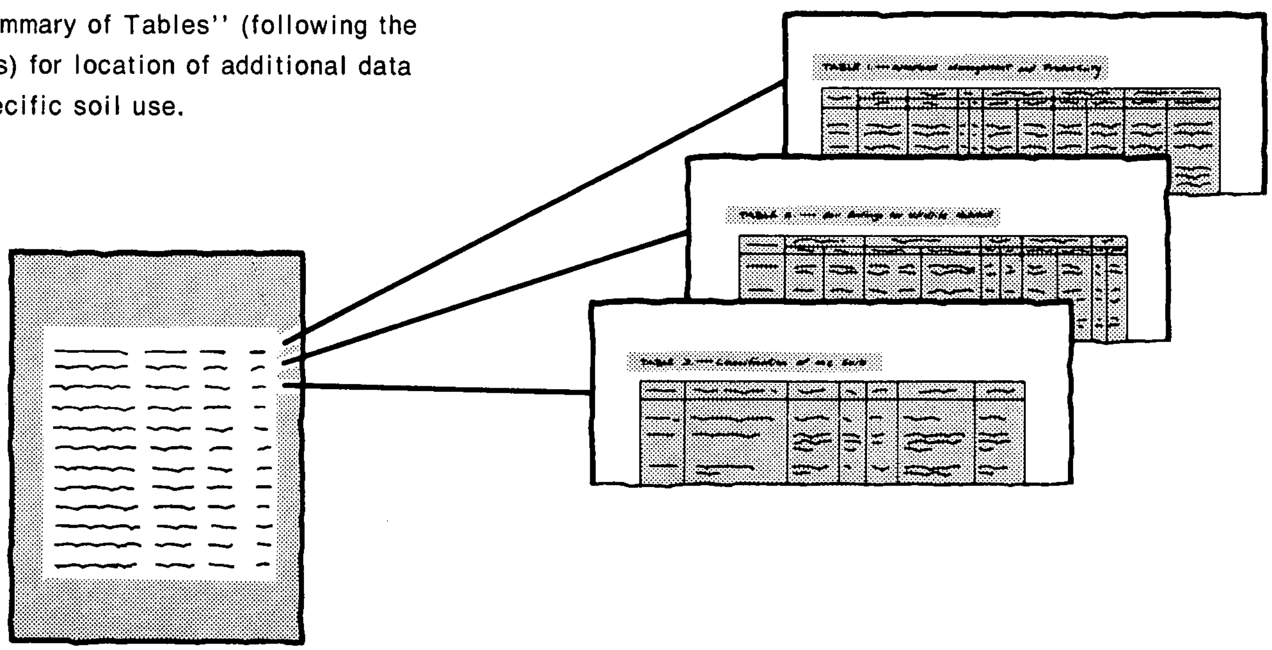


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in 1980. Soil names and descriptions were approved in 1981. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1981. This survey was made cooperatively by the Soil Conservation Service and the Missouri Agricultural Experiment Station. The City of Kansas City provided funds to map the corporate part of Kansas City. The Missouri Department of Natural Resources provided a soil scientist to assist in the fieldwork. This soil survey is part of the technical assistance furnished to the Platte County Soil and Water Conservation District.

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

This soil survey supersedes the survey of Platte County, Missouri that was published in 1911 (*10*).

Cover: A tobacco field in an area of Sibley soils. Tobacco is one of the specialty crops grown in Platte County.

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Foreword

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

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

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

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

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Soil Survey of
Platte County, Missouri

By George D. Preston, Soil Conservation Service

Fieldwork by George D. Preston and Richard E. McBee,
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United States Department of Agriculture, Soil Conservation Service
in cooperation with the Missouri Agricultural Experiment Station

Platte County is in northwestern Missouri (fig. 1). To the west and south it is bordered by the Missouri River. Platte City, the county seat, is located near the center of the county. In 1980 the population of Platte City was 2,123, and the population of the county was 46,207. The county has a total of 273,478 acres, or 427.3 square miles.

Platte County is in the Iowa and Missouri Deep Loess Hills Land Resource Area of the Central Feed Grains and Livestock Region of the United States (*3*). Farming is the main enterprise, although commerce and industry are becoming increasingly important in the southern part of the county. The principal crops are corn, soybeans, wheat, grain sorghum, and tobacco. Beef cattle and hogs are the livestock most commonly raised. The county has forested areas, mostly along the drainageways in the uplands and in the steeper areas along the bluffs adjacent to the Missouri River bottoms.

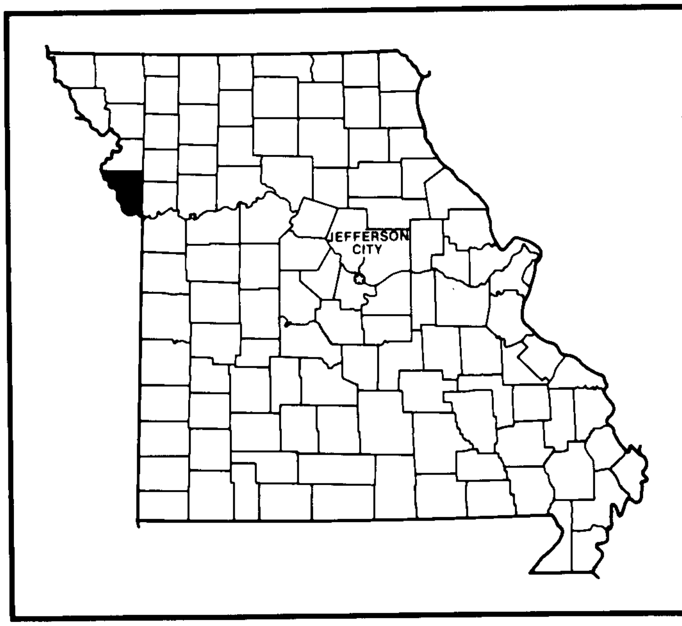

Figure 1.—Location of Platte County in Missouri.

General Nature of the County

This section gives general information concerning the county. It discusses climate, history and development, relief and drainage, water supply, and farming.

Climate

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

Platte County, Missouri consistently has cold winters and long, hot summers. Heavy rains occur mainly in spring and early in summer, when moist air from the Gulf of Mexico interacts with drier continental air.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Kansas City, Missouri in the period 1951 to 1979. 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 33 degrees F, and the average daily minimum temperature is 24 degrees. The lowest temperature on record, which occurred at Kansas City on February, 1, 1979, is -10 degrees. In summer the average temperature is 78 degrees, and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred on July 13, 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 35.75 inches. Of this, 25 inches, or 70 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 7.45 inches at Kansas City on August 15, 1969. Thunderstorms occur on about 55 days each year, and most occur in summer.

The average seasonal snowfall is 22 inches. The greatest snow depth at any one time during the period of record was 21 inches. On an average of 10 days during the winter, at least 1 inch of snow is 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 75 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 12 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. They are local and of short duration. Damage varies and is spotty. Hailstorms occur at times during the warmer part of the year, in an irregular pattern and in small areas.

History and Development

The earliest inhabitants of Platte County for whom written records exist are the Missouri Indians. The Missouris were a powerful tribe, who laid claim to land along both sides of the Missouri River and along the Mississippi River north into Iowa. However, by 1833 the tribe had been nearly exterminated through constant warfare with other powerful tribes in the surrounding territories. This loss of power by the Missouris left large regions of what is presently northwestern Missouri open to the conflicting claims of the Osage, the Iowas, and the Sacs and Foxes. Each tribe refused to recognize any claim by the others, resulting in many conflicts and battles, none of which was decisive (*14*).

When Missouri was admitted to statehood in 1821, the area in northwestern Missouri which is now Platte, Buchanan, Andrew, Holt, Atchison, and Nodaway Counties was not included as part of the state. This land had been set aside for the Indians and was not added to Missouri until 1836, through the Platte Purchase Agreement. Before 1836, white settlers were excluded from northwestern Missouri and, on at least one occasion, the Army physically evicted squatters who had tried to take up land within the area. The first settler in the area that is now Platte County was Zadoc Martin, who, under special permit from the Army, operated a ferry at the Falls of the Platte, on the military road running from Liberty to Fort Leavenworth.

Following ratification of the Platte Purchase Agreement in February of 1837, the area that is now Platte County was attached for civil purposes to Clay County. However, the settlement of the area was so rapid that by the end of that year nearly every available quarter section had been claimed, and in December of 1838, Platte County was formed.

Most of the early settlers came in search of productive soils to farm. Hemp became a profitable money crop and was raised extensively until labor shortages in the 1870's deeply curtailed production. A prosperous agricultural economy was aided by the close proximity of Fort Leavenworth and the immigration trails to Oregon and to the gold fields in California (*14*).

During the Civil War agricultural progress came to a standstill. Crops were destroyed, and most of the livestock was stolen by jayhawkers and red legs from Kansas. The population of the county declined during this period.

After the war, agricultural production recovered rapidly. Wheat was the major grain crop, and beef cattle the most important type of livestock. Corn soon became a major crop, and wheat and corn remained the major crops until the 1950's. Soybeans and grain sorghum became prominent in the 1950's, and since then the acreage of corn and wheat has declined. Tobacco is an important cash crop; Platte County has the only tobacco auction west of the Mississippi River.

Agricultural production dominated the economy of Platte County until the early 1960's, when annexation by Kansas City and construction of Kansas City International Airport began to change the character of the southern part of the county.

Relief and Drainage

Relief in Platte County ranges from 1,190 feet near the headwaters of Bear Creek, in the northwest, to 730 feet at the point where the Missouri River leaves the county, in the southeast. The Missouri River drops approximately

40 feet as it flows from the northwestern to the southeastern corner of the county. Local relief varies as much as 310 feet from the crest of the River Bluff to the Missouri River flood plain north of Weston.

The drainage system for Platte County is controlled by the Missouri River, which enters the county at its northwestern corner, forming the boundary with Kansas, and exits at the southeastern corner.

Other major systems include the Platte River and Bee Creek drainages, which enter the Missouri River directly, and the Little Platte River, which enters as part of the Platte River system.

The Platte River enters the county in the northeast near Edgerton and flows through the central part of the county to enter the Missouri River near Farley. The Little Platte River enters the county from the east, near Smithville in Clay County, and joins the Platte River in the central part of the county. Bee Creek enters Platte County from the north near Dearborn and flows toward the southwest through the north-central portion of the county, joining the Missouri River near Beverly.

Water Supply

The principal source of present and future groundwater supplies is alluvium along the Missouri River. This source is widely exploited in Kansas City and North Kansas City. Wells of modern construction, in favorable locations, can yield more than 2,000 gallons of water per minute. However, based on data from the Kansas City area, yields between 500 and 1,500 gallons per minute, averaging about 1,000 gallons per minute, can commonly be expected.

Shallow wells dug in the alluvium along the smaller streams produce small amounts of water. Wells in the alluvium along the Platte River yield up to a few hundred gallons a minute. Both Platte City and Tracy obtain water from alluvium along the Platte River. A number of rural water districts also obtain water from alluvium along the Platte River.

Water from the consolidated rock formations that underlie Platte County is generally of poor quality. Yields are low, and wells tend to go dry during periods of low rainfall. Gravel at the base of underlying Kansan till is a favorable aquifer and can yield water to wells in the eastern and north-central parts of the county, where the landscape is not deeply dissected (*5*).

Most of the soils on uplands are suitable for the construction of ponds and small lakes for use as water supply for household purposes and livestock.

Farming

The area that is now Platte County was first opened for settlement in 1837. Settlement was so rapid that by the end of the year nearly every available quarter section had been claimed. Tobacco was the first cash crop; hemp, however, was a more profitable crop and soon replaced tobacco. As more land became available, wheat and corn became important crops.

The importance of hemp declined soon after the end of the Civil War. Tobacco, corn, soybeans, and wheat are presently the important crops. A significant amount of farm income derives from livestock production.

The general trend in farming is toward larger farms and fewer farmers. The amount of land in farms is decreasing. The use of fertilizers, chemicals, and larger machinery is increasing.

Agriculture remains the predominant enterprise in Platte County. However, since the construction of Kansas City International Airport in the southern part of the county, business and industry have become increasingly important.

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

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

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use of 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 soils 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 to precisely define and locate the soil 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 broad areas called soil associations that have a distinctive pattern of soils, relief, and drainage. Each soil association on the general soil map is a unique natural landscape. Typically, a soil 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 other associations but in a different pattern.

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

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

Soil Descriptions

1. Sharpsburg-Higginsville-Sibley association

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

This association consists of soils on wide ridgetops and side slopes on the higher divides between large streams (fig. 2).

This association makes up about 35 percent of the county. It is about 40 percent Sharpsburg soils, 16 percent Higginsville soils, 15 percent Sibley soils, and 29 percent soils of minor extent.

The Sharpsburg soils are gently sloping to strongly sloping and are moderately well drained. They are commonly in lower positions on the landscape than Sibley soils. The surface and subsurface layers are very dark grayish brown silt loam. The subsoil is dark brown and dark yellowish brown silty clay loam in the upper part; dark brown silty clay loam in the middle part; and mottled dark yellowish brown and grayish brown silty clay loam in the lower part. The substratum is mottled yellowish brown and grayish brown silty clay loam.

The Higginsville soils are moderately sloping and are somewhat poorly drained. They are on slightly concave side slopes and heads of drains. The surface layer is black silt loam. The subsoil is very dark grayish brown silty clay loam in the upper part; mottled dark grayish brown silty clay loam in the middle part; and mottled grayish brown silty clay loam in the lower part. The substratum is mottled grayish brown, light brownish gray, and brown silty clay loam.

The Sibley soils are gently sloping and moderately sloping and are well drained. They are in higher positions than Sharpsburg and Higginsville soils. The surface layer is very dark grayish brown silt loam, and the subsurface layer is very dark brown silty clay loam. The subsoil is very dark grayish brown and dark brown silty clay loam in the upper part; brown silty clay loam in the middle part; and mottled brown silt loam in the lower part. The substratum, to a depth of 65 inches or more, is mottled dark yellowish brown silt loam.

Of minor extent in this association are Armster, Kennebec, and Snead soils. Armster soils have glacial sand and pebbles and are on lower slopes than Sharpsburg and Sibley soils. Kennebec soils have less clay than the major soils and are on bottom lands. Snead soils are moderately deep to shale and are on side slopes, in lower positions.

The soils in this association are suited to cultivated crops. The major crops are corn, soybeans, grain sorghum, and wheat. The hazard of erosion is the main management concern. Installing a terrace and waterway system or using minimum tillage and crop residue management helps prevent excessive erosion.

The soils in this association are generally suited to onsite waste disposal and building site development. Wetness, high shrink-swell potential, low strength, and slope are limitations.

2. Knox-Snead association

Deep and moderately deep, moderately sloping to steep, well drained and moderately well drained soils that formed in loess and in residuum of shale and limestone; on uplands

This association consists of soils on deeply dissected narrow ridges and valleys adjacent to the Missouri River flood plain (fig. 3).

This association makes up about 31 percent of the county. It is about 77 percent Knox soils, 14 percent Snead soils, and 9 percent soils of minor extent.

Knox soils are deep and are moderately sloping to steep. They are well drained. Generally they are in higher positions on the landscape than Snead soils. The

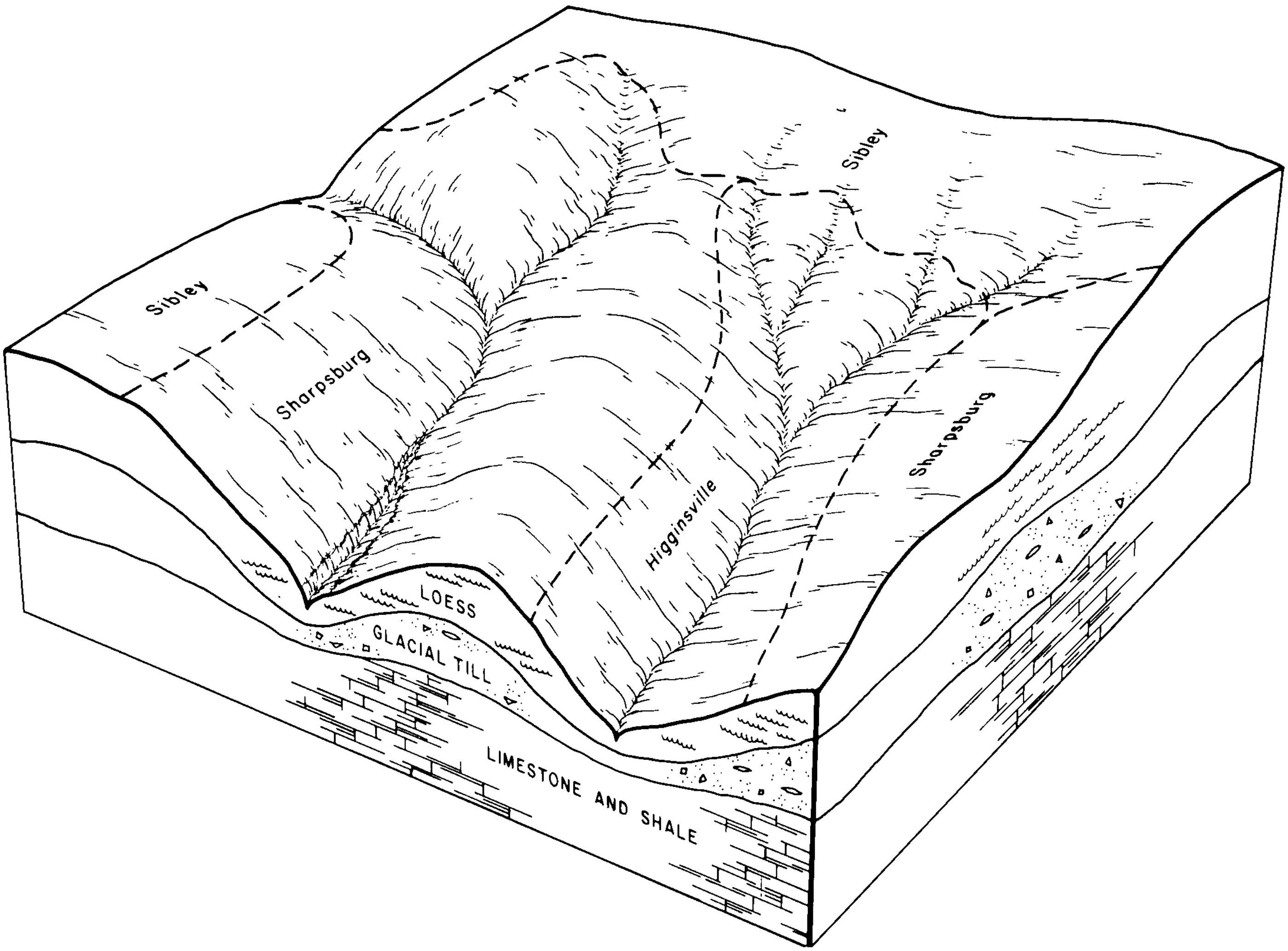

Figure 2.—Typical pattern of soils and parent material in the Sharpsburg-Higginsville-Sibley association.

surface layer is dark brown silt loam, the subsoil is dark yellowish brown silty clay loam, and the substratum is dark yellowish brown silt loam.

Snead soils are moderately deep and are moderately sloping to steep. They are moderately well drained. These soils are on side slopes. Generally narrow bands of Rock outcrop are directly upslope from the Snead soils. The surface layer is very dark gray flaggy silty clay loam. The subsurface layer is very dark grayish brown flaggy silty clay loam. The subsoil is mottled dark grayish brown flaggy silty clay and silty clay. Soft grayish brown shale is at a depth of about 25 inches.

Of minor extent in this association are Armster, Ladoga, Nodaway, and Sibley soils. Armster soils have glacial sand and pebbles and are located between Knox and Snead soils. Ladoga soils are deep, have a more clayey subsoil than the Knox soils, and are farther from the streams. Nodaway soils are silty throughout and are on bottom lands. Sibley soils are deep, have a thicker surface layer, and are on broader ridgetops than the Knox soils.

The soils in this association are used mainly for pasture and as woodland. In the southern part of the county, a significant acreage is used for urban development, especially residential buildings.

The soils in this association generally are not suited to cultivated crops; the soils on ridgetops are best suited to use as cropland. Erosion is a major hazard. The deep soils in this association are well suited to use for orchards. Most of the soils are suited to use as pasture. Slope and the hazard of erosion are major management concerns for orchards and pasture.

About 20 percent of the acreage is in woodland; the soils are suited to this use. Oak, hickory, ash, and black walnut are the dominant species. The steep slopes limit the use of logging equipment. Erosion is a hazard along logging roads and skid trails.

The deep, moderately sloping and strongly sloping soils in this association are suited to onsite waste disposal systems and building site development. The moderately steep and steep soils generally are not suited to urban uses.

3. Ladoga-Snead-Armster association

Deep and moderately deep, gently sloping to steep, moderately well drained soils that formed in loess, in residuum of shale and limestone, and in pedisediment and glacial till; on uplands

This association consists of soils on dissected narrow ridges and valleys adjacent to the flood plains of intermediate and small streams (fig. 4).

This association makes up about 8 percent of the county. It is about 43 percent Ladoga and similar soils, 33 percent Snead soils, 12 percent Armster soils, and 12 percent soils of minor extent.

Ladoga soils are deep, gently sloping to strongly sloping, and moderately well drained. They are on narrow ridgetops and convex side slopes. The surface layer is very dark grayish brown silt loam. The subsurface layer is mixed dark grayish brown and brown silt loam. The subsoil is dark yellowish brown and dark yellowish brown, mottled silty clay loam. The substratum is brown, mottled silty clay loam.

Snead soils are moderately deep, strongly sloping to steep, and moderately well drained. They are on convex side slopes. The surface layer is very dark gray, flaggy

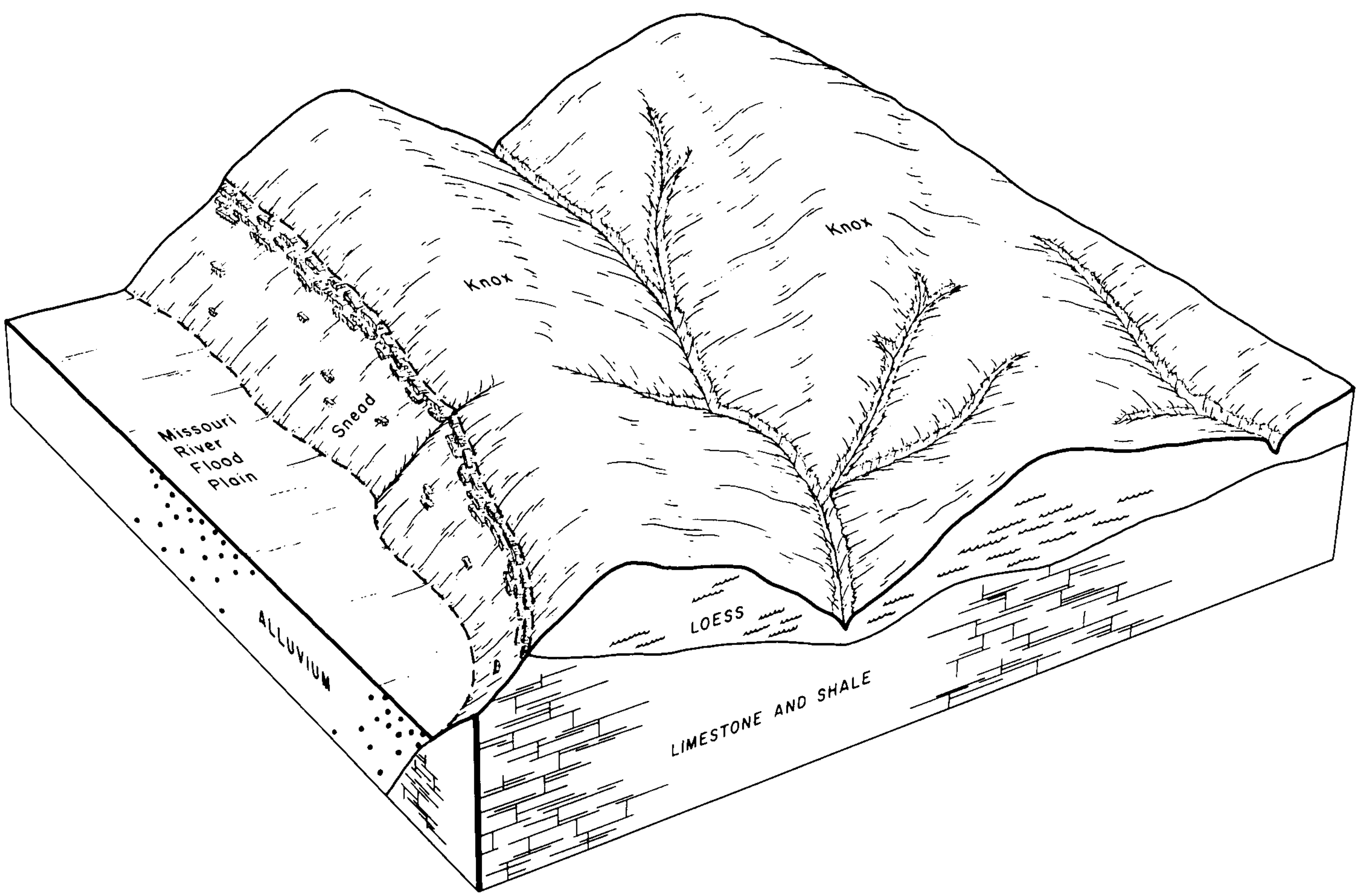

Figure 3.—Typical pattern of soils and parent material in the Knox-Snead association.

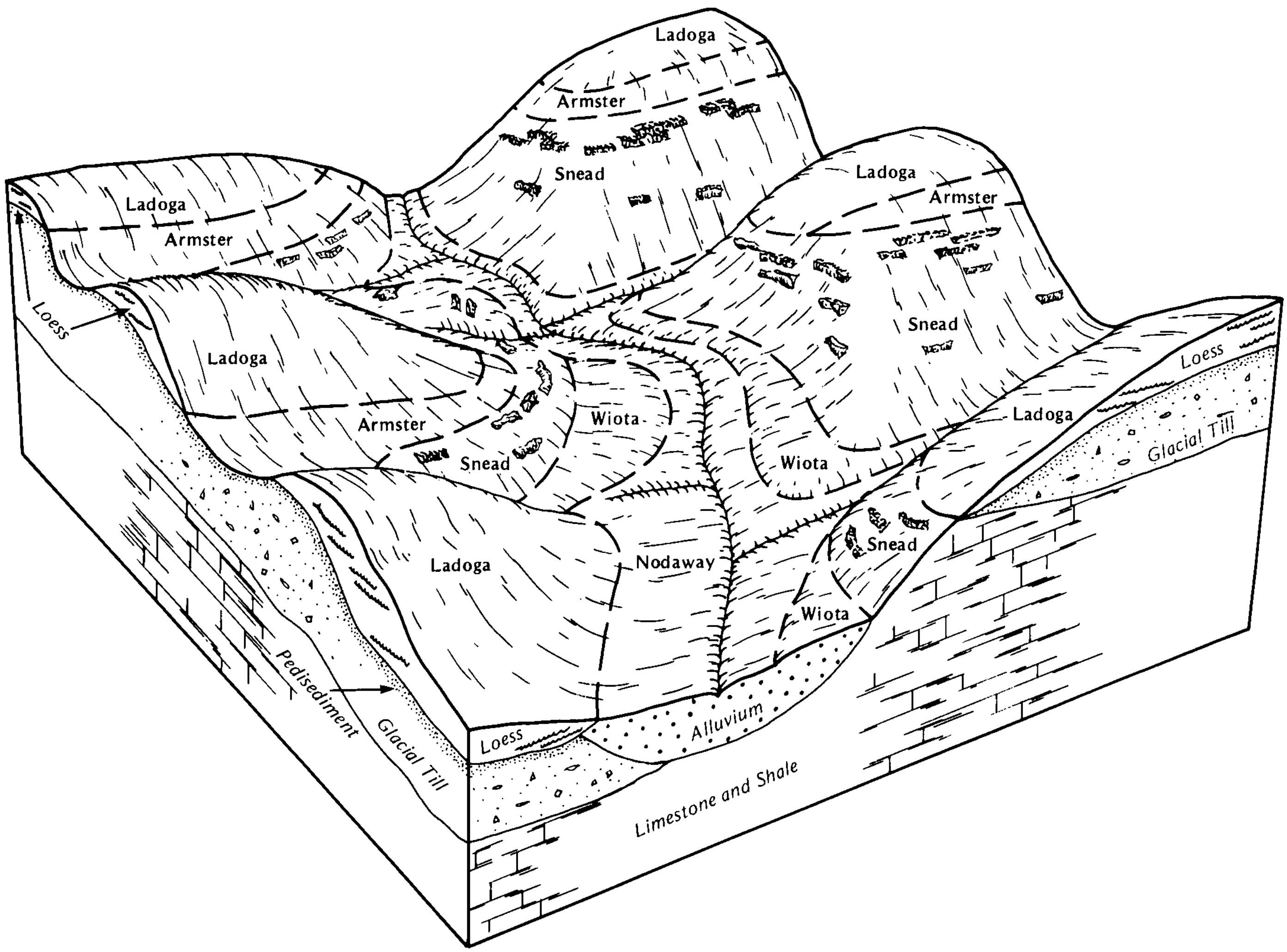

Figure 4.—Typical pattern of soils and parent material in the Ladoga-Snead-Armster association.

silty clay. The subsurface layer is very dark grayish brown, flaggy silty clay loam. The subsoil is dark grayish brown, mottled, flaggy silty clay and silty clay. Soft grayish brown shale is at a depth of 25 inches.

Armster soils are deep, strongly sloping, and moderately well drained. They are on convex side slopes. The surface layer is very dark grayish brown loam. The subsoil is brown clay loam in the upper part; reddish brown clay in the middle part; and yellowish brown, mottled clay in the lower part.

Of minor extent in this association are the Higginsville, Nodaway, and Sibley soils. Higginsville soils are grayer, have less clay, and are on slightly concave side slopes. Nodaway soils are silty throughout and are on narrow bottom lands. Sibley soils are deep, have a thick dark surface layer, and are on convex ridgetops and side slopes.

About 65 percent of the acreage in this association has been cleared. Corn, soybeans, grain sorghum, and small grains are grown on the deep, gently sloping to strongly sloping soils. In the other cleared areas the soils are used for pasture and hay. Slope and erosion are the major limitations in pasture and cropland management.

The soils in this association are suited to trees. The dominant species are red oak, black oak, hickory, and ash. The steep slopes limit the use of logging equipment. Erosion is a hazard along logging roads and skid trails.

The steep soils and the moderately deep soils generally are not suitable for urban uses. The soils on ridgetops are suitable for building sites. The main limitations are shrink-swell potential and slope. These soils generally are not suitable for conventional septic tank absorption fields because of the moderately slow permeability and steep slopes.

4. Nodaway-Colo-Wiota association

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

This association consists of soils on terraces and bottom lands along the intermediate and small streams (fig. 5).

This association makes up about 11 percent of the county. It is about 39 percent Nodaway soils, 16 percent Colo and similar soils, 14 percent Wiota soils, and 31 percent soils of minor extent.

The Nodaway soils are nearly level and moderately well drained. They commonly are on the flood plain, adjacent to the stream channel. The surface layer is stratified very dark grayish brown and very dark gray silt loam. The substratum is stratified dark grayish brown, grayish brown, black, very dark gray, and very dark grayish brown silt loam.

The Colo soils are nearly level and poorly drained. They are on the flood plain, commonly in backwater areas farther from the stream channel than the Nodaway soils. The surface layer is very dark grayish brown silt loam. The subsurface layer is black, mottled silty clay loam in the upper part and very dark gray, mottled silty clay loam in the lower part.

The Wiota soils are nearly level and well drained. They are on low terraces that are rarely flooded. The surface layer is black silt loam, and the subsurface layer is black silty clay loam. The subsoil is very dark grayish brown silty clay loam in the upper part; brown silty clay loam in the middle part; and dark yellowish brown silty clay loam in the lower part. The substratum is dark yellowish brown silty clay loam.

Of minor extent in this association are the Dockery and Kennebec soils. Dockery soils have less clay than Colo and Wiota soils and are grayer than Nodaway soils. They are on backwater areas that receive a large

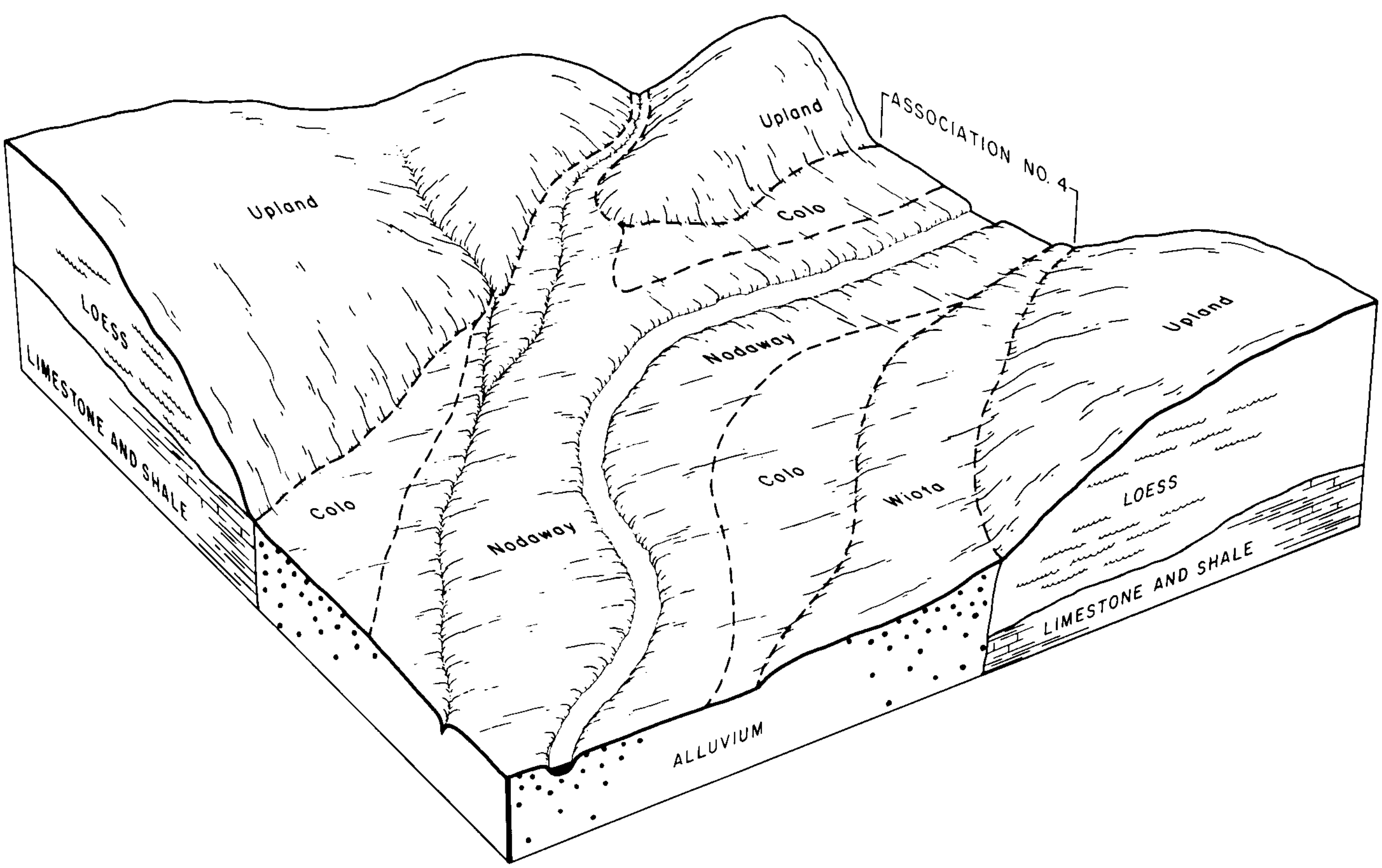

Figure 5.—Typical pattern of soils and parent material in the Nodaway-Colo-Wiota association.

amount of fresh sediment. Kennebec soils are dark throughout and have less clay than Colo and Wiota soils. They are in areas where small streams enter the valley of a larger stream.

The soils in this association are used almost exclusively for cultivated crops. Flooding and wetness are the main hazards. If drainage and protection from flooding are provided, these soils are very productive. The Wiota soils are well suited to alfalfa.

The soils in this association generally are not suited to sanitary facilities and building site development because of the hazard of flooding.

5. Haynie-Parkville-Leta association

Deep, nearly level, moderately well drained and somewhat poorly drained soils that formed in alluvium; on flood plain of the Missouri River

This association consists of soils in nearly level, slightly convex, slightly concave, and depressional areas on the broad flood plain of the Missouri River (fig. 6).

This association makes up about 15 percent of the county. It is about 50 percent Haynie soils, 22 percent Parkville soils, 11 percent Leta soils, and 17 percent soils of minor extent.

The Haynie soils are nearly level and moderately well

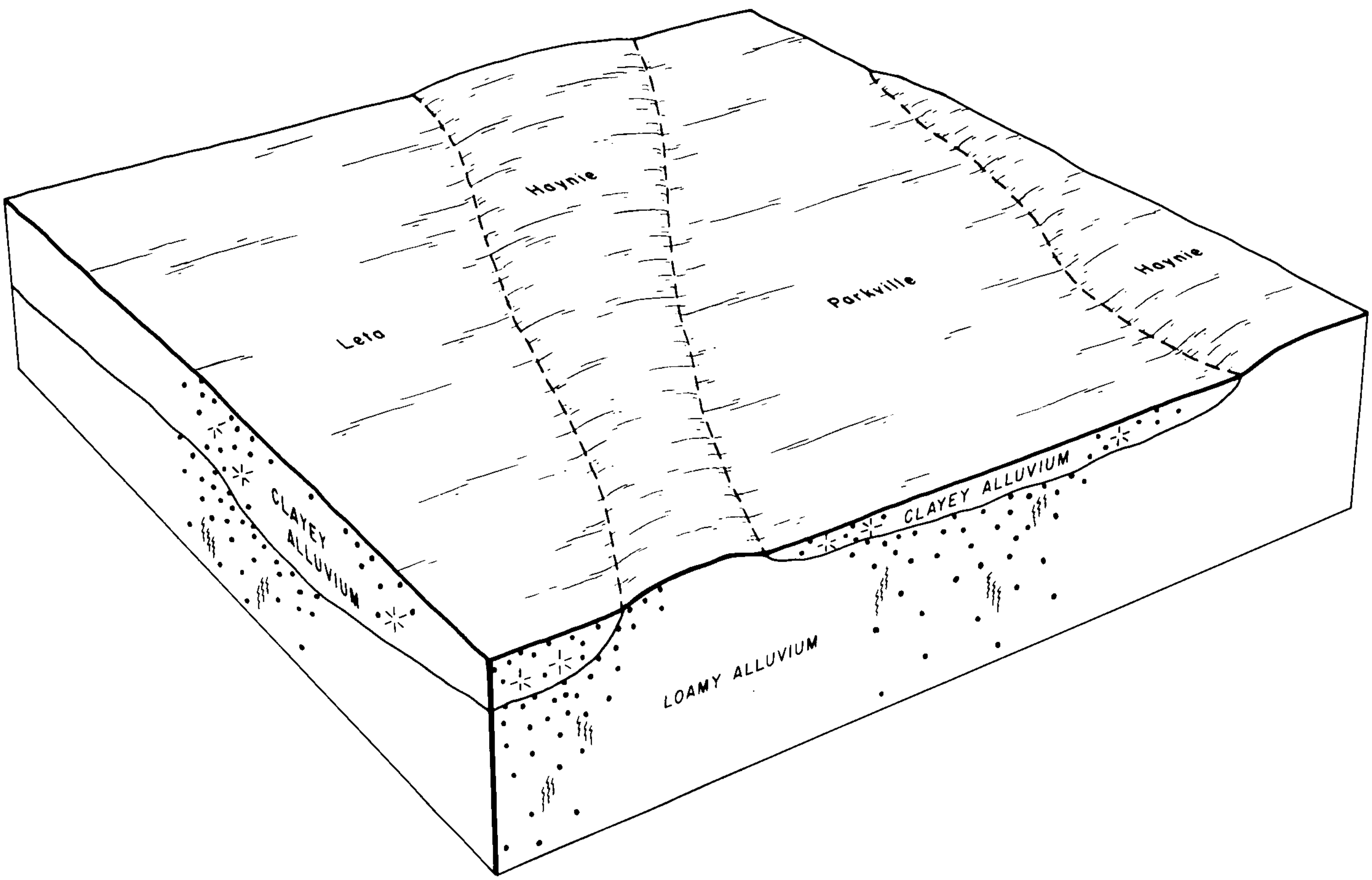

Figure 6.—Typical pattern of soils and parent material in the Haynie-Parkville-Leta association.

drained. They are on low natural levees of flood plains. The surface layer is very dark grayish brown silt loam. The substratum is grayish brown very fine sandy loam in the upper part; brown, mottled very fine sandy loam in the middle part; and stratified, mottled, grayish brown and brown very fine sandy loam in the lower part underlain by dark grayish brown, mottled, firm silty clay loam.

The Parkville soils are nearly level and somewhat poorly drained. They are at a lower elevation, adjacent to the Haynie soils and farther from the stream channel. The surface layer and subsurface layer are very dark grayish brown silty clay loam. The substratum is dark grayish brown very fine sandy loam.

The Leta soils are nearly level and somewhat poorly drained. They are in broad, nearly level areas on the lower bottom land. The surface layer is black silty clay. The subsurface layer is very dark brown silty clay. The subsoil is dark grayish brown, mottled silty clay loam. The substratum is grayish brown, mottled very fine sandy loam.

Of minor extent in this association are the Levasy, Sarpy, and Waldron soils. Levasy soils are grayer than Parkville and Leta soils. They are in broad depressional areas in lower positions on the landscape than the Leta soils. Sarpy soils are excessively drained, have more sand, and are in high positions on sandy ridges. Waldron soils are clayey throughout and in nearly level areas low on the landscape.

The soils in this association are used extensively for cultivated crops. They generally are well suited to this use if drainage and protection from flooding are provided.

This association generally is not suited to sanitary facilities and building site development because of the hazard of flooding, high shrink-swell potential, and wetness.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Knox silt loam, 5 to 9 percent slopes, eroded is one of several phases in the Knox series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils, or a soil 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. Snead-Rock outcrop complex, 5 to 14 percent slopes, is an example.

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

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.

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

1B—Sibley silt loam, 2 to 5 percent slopes. This is a deep, gently sloping, well drained soil on moderately wide convex ridgetops. Individual areas of this unit are long and moderately wide and range from 20 to 80 acres.

Typically, the surface layer is very dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is very dark brown, friable silty clay loam about 10 inches thick. The subsoil is about 38 inches thick. The upper part is very dark grayish brown and dark brown, friable silty clay loam; the middle part is brown, friable silty clay loam; and the lower part is brown, mottled, friable silt loam. The substratum, to a depth of 65 inches, is dark yellowish brown, mottled friable silt loam. In some small areas, the dark surface soil is less than 24 inches thick, and grayish brown mottles are above a depth of 36 inches.

Included with this soil in mapping, and making up less than 5 percent of the map unit, are small areas of well drained Knox soils. The Knox soils have a dark surface layer less than 10 inches thick and are on ridge points near major streams.

Permeability is moderate, and surface runoff from cultivated areas is medium. Available water capacity is very high. The subsoil is slightly acid to medium acid. The surface layer varies in reaction according to local liming practices. Natural fertility is high, and content of organic matter is moderate. The surface layer is friable and is easily tilled within a moderately wide range of moisture content. It does, however, have a tendency to crust or puddle after a hard rain, especially if plowed when wet. The shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, grain sorghum, and small grains. If the soil is used for cultivated crops, erosion is a hazard. Conservation tillage, crop residue management, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue or regularly adding other organic material helps improve fertility, reduce crusting, and increase water infiltration.

This soil is suited to use as pasture and hayland. It is well suited to alfalfa and smooth bromegrass. Using the soil for pasture and hay effectively controls erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is suited to onsite waste disposal and building site development if proper design and installation procedures are used. If the soil is used for sewage lagoons, excess seepage is a problem. This problem can be corrected by using slowly permeable material to seal the bottom of the lagoon. Septic tank absorption fields function if installed properly. Backfilling with sand and gravel around the foundation or basement wall helps prevent structural damage caused by the shrinking and swelling of the soil. This soil is not sufficiently strong to support vehicular traffic. However, this limitation can be overcome by adding crushed rock or other suitable base material. Grading the roads to shed water and providing adequate side ditches and culverts help prevent damage caused by frost action and the shrinking and swelling of the soil.

This soil is in capability subclass IIe. It was not assigned to a woodland group.

1C—Sibley silt loam, 5 to 9 percent slopes. This is a deep, moderately sloping, well drained soil on convex side slopes. Individual areas of this map unit are irregular in shape and range from 10 to 40 acres.

Typically, the surface layer is very dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 5 inches thick. The subsoil is about 29 inches thick. The upper part is very dark grayish brown, friable silty clay loam; the middle part is dark brown, friable silty clay loam; and the lower part is dark yellowish brown, friable silty clay loam. The substratum, to a depth of about 60 inches, is dark yellowish brown, friable silt loam. In places, the dark surface soil is less than 24 inches thick, and grayish brown mottles are above a depth of 36 inches.

Included with this soil in mapping, and making up less than 5 percent of the map unit, are small areas of Higginsville soils. Higginsville soils are somewhat poorly drained and are in the heads of drainageways and on the lower part of side slopes.

Permeability is moderate, and surface runoff from cultivated areas is medium. Available water capacity is very high. The soil ranges from medium acid to slightly acid. The surface layer varies in reaction according to local liming practices. Natural fertility is high, and content of organic matter is moderate. The surface layer is friable and can be tilled within a moderately wide range of moisture conditions. However, it tends to crust or puddle, especially after a hard rain. The shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, small grains, and grain sorghum. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. In most areas the slopes are long enough to be terraced and farmed on the contour. Returning crop residue or regularly adding other organic material helps improve fertility, reduce crusting, and increase water infiltration.

This soil is suited to use as pasture or hayland. Alfalfa and smooth bromegrass grow well. Using the soil as pasture or hayland effectively controls erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is suited to onsite waste disposal and building site development if proper design and installation procedures are used. Seepage and slope are limitations for sewage lagoons. Seepage can be prevented by using slowly permeable material to seal the bottom of the lagoon. Lagoons can be located in a less sloping area, or the area can be leveled. Septic tank absorption fields function if properly installed. They should be located in a less sloping area, or the system can be designed to fit the slope. Basement walls and foundations for dwellings and other buildings should be constructed so as to prevent structural damage caused by the shrinking and swelling of the soil. Backfilling around the basement or foundation with sand and gravel and providing good surface drainage are effective practices. The soil is not sufficiently strong to support vehicular traffic. This limitation can be corrected by adding crushed rock to the base material. Grading the roads to shed water and providing adequate side ditches and culverts help prevent damage caused by frost action and the shrinking and swelling of the soil.

This soil is in capability subclass IIIe. It was not assigned to a woodland group.

2C2—Higginsville silt loam, 5 to 9 percent slopes, eroded. This is a deep, moderately sloping, somewhat poorly drained soil on slightly concave side slopes on uplands. Individual areas of this map unit are irregular in shape and range from 40 to 500 acres.

Typically, the surface layer is black, friable silt loam about 8 inches thick. The subsoil is about 34 inches thick. The upper part is very dark grayish brown, friable silty clay loam; the middle part is dark grayish brown, mottled, friable silty clay loam; and the lower part is grayish brown, mottled, friable silty clay loam. The substratum, to a depth of about 60 inches, is mottled grayish brown, light brownish gray, and brown, friable silty clay loam.

Included with this soil in mapping, and making up about 10 percent of the map unit, are small areas of moderately well drained Armster and Sharpsburg soils and well drained Sibley soils. Armster soils are on the lower foot slopes. Sharpsburg and Sibley soils are near the upper convex part of the slope, where surface drainage is better.

Permeability is moderate, and surface runoff is medium. Available water capacity is high. The subsoil ranges from medium acid to neutral. The surface layer varies in reaction according to local liming practices. Natural fertility is high, and the content of organic matter is moderate. A seasonal high water table is at a depth of 1.5 to 3 feet. The surface layer is friable and is easily tilled within a fairly wide range in moisture content. It does, however, have a tendency to crust or puddle after a hard rain, especially in areas where plowing has mixed the surface layer with subsoil material. The shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, grain sorghum, and small grains. If the soil is used for cultivated crops, further erosion is a hazard. Conservation tillage, winter cover crops, stripcropping, and terrace systems help prevent excessive soil loss. In most areas this soil can be terraced or stripcropped on the contour. In some areas the soil is wet and seepy; however, properly placed tile helps correct this problem. Returning crop residue or regularly adding other organic material helps improve fertility, reduce crusting, and increase water infiltration.

This soil is suited to grasses and shallow-rooted legumes that tolerate wetness. Using the soil as pastureland or hayland effectively controls erosion. However, overgrazing or grazing when the soil is wet causes surface compaction and excessive runoff and damages the stand. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suitable for building site development and for onsite waste disposal if proper design and installation procedures are used. Using reinforced concrete and backfilling around the foundation and basement walls with sand or gravel help prevent problems caused by shrinking and swelling of the soil. Excessive wetness can be overcome by installing drainage tile around the base of the foundation. Slope and wetness are limitations for sewage lagoons. Sewage lagoons function, however, if a less sloping area is used, or the area is leveled. It may be necessary to seal the bottom of the lagoon to prevent contamination of the ground water. Generally this soil is not suited to septic tanks. The soil is not sufficiently strong to support vehicular traffic. Roads are subject to damage by frost action, wetness, and the shrinking and swelling of the soil. These limitations can be overcome by adding crushed rock or other suitable base material, grading the roads to shed water, and providing adequate side ditches and culverts.

This soil is in capability subclass IIIe. It was not assigned to a woodland group.

6B—Sharpsburg silt loam, 2 to 5 percent slopes. This is a deep, gently sloping, moderately well drained soil on upland ridgetops. Individual areas of this map unit are long and narrow and range from 20 to 200 acres.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 5 inches thick. The subsoil is about 42 inches thick. In the upper part it is mixed dark brown and dark yellowish brown, friable silty clay loam; in the middle part it is mottled dark brown and dark yellowish brown, firm silty clay loam; and in the lower part it is mottled dark yellowish brown, grayish brown, and strong brown, firm silty clay loam. The substratum, to a depth of about 60 inches, is mottled yellowish brown and grayish brown, friable silty clay loam. In places, the dark surface soil is more than 24 inches thick, and gray mottles are below a depth of 36 inches. In other places, the dark surface soil is less than 10 inches deep.

Included with this soil in mapping are small areas of Higginsville soils. The Higginsville soils are somewhat poorly drained and are at the head of drainageways.

Permeability is moderately slow, and surface runoff is medium. Available water capacity is high. Natural fertility is high, and content of organic matter is moderate. The soil is medium acid or slightly acid. The surface layer is friable and easily tilled. It does, however, have a tendency to crust or puddle after a heavy rain, especially in areas where plowing has mixed the surface layer with the subsoil. The shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops (fig. 7). It is suited to corn, soybeans, grain sorghum, small grains, and other cultivated crops. If the soil is used for cultivated crops, erosion is a hazard. Conservation tillage, stripcropping, winter cover crops, terraces, and waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps improve fertility, reduce crusting, and increase water infiltration.

Using the soil for pasture or as hayland effectively controls erosion. This soil is suited to alfalfa and smooth bromegrass. Overgrazing or grazing when the soil is wet

Figure 7.—Soybeans on Sharpsburg silt loam, 2 to 5 percent slopes, a prime farmland soil.

causes surface compaction, excessive runoff, and damage to the stand. Fertilization, proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

The moderate shrink-swell potential and the moderately slow permeability are limitations for building site development and onsite waste disposal. Using adequately reinforced concrete and backfilling with sand and gravel around the foundation help prevent structural damage caused by the shrinking and swelling of the soil. Septic tanks function properly if the size of the absorption field is increased. The soil is suited to sewage lagoons, although the bottom of the lagoon may need to be sealed with slowly permeable material to prevent seepage. Low strength, frost action, and shrink-swell potential are limitations for local roads and streets. Using crushed rock or other suitable base material helps prevent damage caused by low strength. Grading the roads to shed water and providing side ditches and culverts help prevent damage caused by frost action and the shrinking and swelling of the soil.

This soil is in capability subclass IIe. It was not assigned to a woodland group.

6C2—Sharpsburg silt loam, 5 to 9 percent slopes, eroded. This is a deep, moderately sloping, moderately well drained soil on convex side slopes on uplands. Individual areas are irregular in shape and range from 10 to 150 acres.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 47 inches thick. The upper part is very dark grayish brown, friable silty clay loam, and the lower part is brown, mottled, firm silty clay loam. The substratum, to a depth of about 60 inches, is grayish brown, mottled, friable silty clay loam. In places, the dark surface soil is more than 24 inches deep, and gray mottles are below a depth of 36 inches. In the north-central part of the survey area, the subsoil has less clay.

Included with this soil in mapping, and making up less than 10 percent of the map unit, are small areas of Higginsville soils. Higginsville soils are somewhat poorly drained and are on side slopes and drainageways, in lower positions than this Sharpsburg soil.

Permeability is moderately slow, and surface runoff is medium. Available water capacity is high. The soil is medium acid or slightly acid. Natural fertility is high, and content of organic matter is moderate. The surface layer is friable and is easily tilled. It does, however, have a tendency to crust or puddle after a heavy rain, especially in areas where plowing has mixed subsoil material with the surface layer. Shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, grain sorghum, and small grains. If the soil is used for cultivated crops, further erosion is a hazard. Conservation tillage, stripcropping, winter cover crops, terraces, and waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps improve fertility, reduce crusting, and increase water infiltration.

This soil is suited to alfalfa and smooth bromegrass. Using the soil as pasture or hayland effectively controls erosion. Overgrazing or grazing when the soil is wet causes surface compaction and excessive runoff and damages the stand. Fertilization, proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

The moderate shrink-swell potential and moderately slow permeability are limitations for building site development and onsite waste disposal. Proper design and construction, including using adequately reinforced concrete in footings and foundations and backfilling with sand or gravel, help prevent damage caused by the shrinking and swelling of the soil. Septic tank absorption fields function if the length of the lateral field is increased to overcome the moderately slow permeability. This soil can be used for sewage lagoons if the site is leveled. Slowly permeable material can be used to seal the bottom of the lagoon. Low strength is a limitation for local roads and streets. Crushed rock or other suitable material should be added to the base material. Grading roads to shed water and providing adequate side ditches and culverts help prevent damage caused by frost action and the shrinking and swelling of the soil.

This soil is in capability subclass IIIe. It was not assigned to a woodland group.

6D2—Sharpsburg silt loam, 9 to 14 percent slopes, eroded. This is a deep, strongly sloping, moderately well drained soil on convex slopes on uplands. Individual areas of this soil are irregular in shape and range from 10 to 80 acres.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 34 inches thick. The upper part is dark brown, friable silty clay loam; the middle part is brown, firm silty clay loam; the lower part is dark yellowish brown, mottled, firm silty clay loam. The substratum, to a depth of about 60 inches, is grayish brown, mottled, friable silt loam. In places, the dark surface soil is less than 10 inches thick. In the north-central part of the survey area, the subsoil has less clay.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of Armster and Higginsville soils. Armster soils have more sand and gravel and are in narrow bands low on the slope. Higginsville soils are grayer and less clayey and are on the side slopes, in lower positions than this Sharpsburg soil.

Permeability is moderately slow, and surface runoff is rapid. Available water capacity is high. The soil is medium acid or slightly acid. Natural fertility is medium, and content of organic matter is moderate. The surface layer is friable and is easily tilled. It does, however, have a tendency to crust or puddle after a heavy rain, especially in areas where plowing has mixed subsoil material with the surface layer. Shrink-swell potential is moderate.

In most areas this soil is used as pasture. It is suited to corn, soybeans, grain sorghum, and small grains. If the soil is used for cultivated crops, further erosion is a severe hazard. Conservation tillage, stripcropping, winter cover crops, terraces, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps improve fertility, reduce crusting, and increase water infiltration.

Using the soil as pasture or hayland effectively controls erosion. Overgrazing when the soil is wet causes surface compaction and excessive runoff and damages the stand. Fertilization, proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

Slope and moderate shrink-swell potential are limitations for building sites. Proper design and construction, including using adequately reinforced concrete in footings and foundations and backfilling with sand or gravel, help prevent damage caused by the shrinking and swelling of the soil. The land can be shaped if necessary, or dwellings can be designed to fit the natural slope. Moderately slow permeability and slope are limitations for septic tanks. The size of the absorption field needs to be increased, and the distribution lines should be installed across the slope. Sewage lagoons can be built if the area is reshaped and leveled.

Low strength is a limitation for local roads and streets. The base material needs to be strengthened with crushed rock or other suitable material. Grading roads to shed water and providing adequate side ditches and culverts help prevent damage caused by frost action and shrinking and swelling of the soil.

This soil is in capability subclass IIIe. It was not assigned to a woodland group.

8—Pits, quarries. This unit consists of areas on the uplands that are, or were, used for limestone quarrying. These areas generally consist of the quarry pits, the stockpiles of lime and crushed rock, the areas covered with overburden spoil, the equipment areas, and the transport roads. They range from 6 to about 80 acres in size.

The small amount of soil material in these areas that is capable of supporting vegetation is quite variable in composition. The kinds of vegetation on these areas are primarily small hardwoods, annual weeds, and perennial grasses.

The active quarry pits are dry, but some of the abandoned pits contain water. It is impractical to identify the soils in this unit, because of the amount of variability of the material. A more detailed onsite investigation is needed on all of these areas prior to a change in the kind of use.

This map unit was not assigned to a capability subclass or a woodland group.

10D—Snead-Rock outcrop complex, 5 to 14 percent slopes. This map unit consists of moderately deep, moderately sloping and strongly sloping, moderately well drained Snead soils on convex side slopes and narrow bands of limestone outcrop (fig. 8). Individual areas range from 20 to 200 acres. They are about 60 to 70 percent Snead soils and 15 to 25 percent Rock outcrop. The Rock outcrop is in such narrow bands it was not practical to map them separately from the Snead soils.

Figure 8.—Typical area of Snead-Rock outcrop complex, 5 to 14 percent slopes.

Typically, the surface layer of the Snead soils is very dark grayish brown, friable, flaggy silty clay loam about 15 inches thick. The subsoil is about 20 inches thick. The upper part is dark brown, firm flaggy silty clay loam, and the lower part is grayish brown, firm silty clay. Soft, grayish brown shale is at a depth of about 35 inches. In places, the slopes are steep.

Included in mapping are narrow bands of deep Armster soils and deep, well drained Knox soils. Armster and Knox soils are in higher positions than the Rock outcrop. Also included are small areas of deep, less clayey Kennebec soils in narrow stream bottoms. The included soils make up 5 to 15 percent of the map unit.

Permeability of the Snead soils is slow, and surface runoff is rapid. Available water capacity is low. The soil is neutral to mildly alkaline. Natural fertility is low, and content of organic matter is moderate. A seasonal high water table is at a depth of 2 to 3 feet in winter and spring. Shrink-swell potential is high. The root zone is 20 to 40 inches thick.

This map unit is suited to trees, and in most areas it remains in native hardwoods. Seedling mortality and stones are management concerns. Planting special stock that is larger than usual helps increase the chance of survival. Stones on the surface are a limitation to the use of equipment. Hand planting or direct seeding is commonly required.

This map unit generally is not suited to cultivated crops or hay because of limestone flags on the surface and in the soil.

This map unit generally is not suited to building site development and onsite waste disposal because of depth to bedrock and Rock outcrop.

This map unit is in capability subclass VIs and in woodland group 4x.

10F—Snead-Rock outcrop complex, 14 to 30 percent slopes. This map unit consists of moderately deep, moderately steep and steep, moderately well drained Snead soils on convex side slopes and narrow bands of limestone outcrop. Individual areas range from 20 to 100 acres. They are about 60 to 70 percent Snead soils and 15 to 25 percent Rock outcrop. The Rock outcrop is in such narrow bands that it was not practical to map them separately from the Snead soils.

Typically, the surface layer of the Snead soil is very dark gray, friable, flaggy silty clay loam about 4 inches thick. The subsurface layer is very dark grayish brown, firm flaggy silty clay loam about 7 inches thick. The subsoil is dark grayish brown, mottled, firm flaggy silty clay and firm silty clay about 14 inches thick. Soft, grayish brown shale is at a depth of about 25 inches.

Included in mapping, and making up 5 to 15 percent of the map unit, are small areas of Armster and Knox soils. Armster and Knox soils are deep to bedrock. Also included are areas of colluvial soils along drainageways.

Permeability is slow, and surface runoff is rapid. Available water capacity is low. The soil is neutral to mildly alkaline. Natural fertility is low, and content of organic matter is moderate. A seasonal water table is at a depth of 2 to 3 feet in winter and spring. Shrink-swell potential is high.

This map unit is suited to trees, and most areas remain in native hardwoods. Erosion is a hazard, the use of equipment is limited because of stones, and seedling mortality is a concern in management. Roads and skid trails should be located on the contour to minimize steepness and length of slope. Seeding may be necessary in disturbed areas after harvesting is completed. In steep areas yarding logs uphill to roads and skid trails may be required. Because of stones on the surface and steep slopes, hand planting or direct seeding is generally required. Planting special stock that is larger than usual helps increase the chance of survival.

This soil is not suited to cultivated crops and pasture or hay because of limestone flags on the surface.

This soil generally is not suited to building site development and onsite waste disposal because of depth to bedrock and stones.

This map unit is in capability subclass VIIs and in woodland group 4x.

26B—Ladoga silt loam, 2 to 5 percent slopes. This is a deep, moderately well drained, gently sloping soil on convex ridgetops. Individual areas are generally long and narrow and range from 15 to 50 acres.

Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsurface layer is about 3 inches of dark grayish brown and brown silt loam. The subsoil is about 31 inches thick. The upper part is dark yellowish brown, firm silty clay loam, and the lower part is dark yellowish brown, mottled, firm silty clay loam. The substratum, to a depth of about 60 inches, is brown, mottled, friable silty clay loam. In places, the dark surface soil is more than 10 inches deep.

Included with this soil in mapping, and making up less than 5 percent of the map unit, are small areas of the well drained Sibley soils. Sibley soils are less clayey and are upslope from Ladoga soils.

Permeability is moderately slow, and surface runoff is medium. Available water capacity is high. The soil ranges from medium acid to strongly acid in the most acid part. Natural fertility is high, and content of organic matter is moderate. The surface layer is friable and is easily worked. However, it does have a tendency to crust or puddle after a hard rain. Shrink-swell potential is moderate in the subsoil.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, grain sorghum, small grains, and grasses and legumes for pasture and hay. If the soil is used for cultivated crops, erosion is a hazard. Conservation tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. In most areas this soil can be terraced and farmed on the contour. Returning crop residue or regularly adding other organic material helps reduce erosion, improve fertility, reduce crusting, and increase water infiltration.

Using the soil as pastureland or hayland effectively controls erosion. Alfalfa and smooth bromegrass grow well. Overgrazing or grazing when the soil is wet causes damage to the stand, surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. In a few small areas it remains in native hardwoods. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed, by site preparation, spraying, or cutting. There are no other hazards or limitations when planting or harvesting trees.

This soil is suited to building site development and onsite waste disposal. Using adequately reinforced footings and foundations and backfilling with sand and gravel help prevent structural damage to dwellings and small commercial buildings caused by shrinking and swelling of the soil. Septic tank absorption fields generally do not function properly because of the moderately slow permeability. Sewage lagoons can be sealed with slowly permeable material to prevent seepage. Low strength is a limitation on sites for local roads and streets. This limitation can be overcome by adding crushed rock or other suitable base material. Grading the roads to shed water and providing adequate side ditches and culverts help prevent damage caused by frost action and shrinking and swelling of the soil.

This soil is in capability subclass IIe and in woodland group 2o.

26C2—Ladoga silt loam, 5 to 9 percent slopes, eroded. This is a deep, moderately well drained, moderately sloping soil on narrow ridgetops and convex side slopes. Individual areas are generally rectangular and range from 5 to 30 acres.

Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil, about 38 inches thick, is dark yellowish brown, firm silty clay loam that is mottled in the lower part. The substratum, to a depth of about 60 inches, is brown, mottled, friable silty clay loam. In places, the dark surface layer is more than 10 inches thick. In other places, the dark surface layer is less than 4 inches thick and is silty clay loam.

Included with this soil in mapping, and making up less than 5 percent of the map unit, are small areas of Armster soils. Armster soils have more sand and gravel and are on side slopes, in lower positions than Ladoga soils.

Permeability is moderately slow, and surface runoff is medium. Available water capacity is high. The soil ranges from medium acid to strongly acid in the most acid part. Natural fertility is high, and content of organic matter is low. The surface layer is friable and is easily tilled. However, it does have a tendency to crust or puddle after a hard rain. Shrink-swell potential is moderate in the subsoil.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, and grain sorghum. If the soil is used for cultivated crops, further erosion is a hazard. In most areas this soil can be terraced and farmed on the contour. Conservation tillage, winter cover crops, and grassed waterways help prevent excessive erosion. Returning crop residue or regularly adding other organic material helps reduce erosion, improve fertility, and increase water infiltration.

This soil is suited to use as hayland or pasture. Using the soil as hayland or pasture effectively controls erosion. Alfalfa and smooth bromegrass grow well. Overgrazing or grazing when the soil is wet causes damage to the stand, surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and in a few small areas it remains in native hardwoods. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed, by site preparation, spraying, or cutting. There are no other hazards or limitations when planting or harvesting trees.

This soil is suited to building site development and onsite waste disposal. Basements and foundations of dwellings and small commercial buildings should be designed and constructed with adequate reinforcement in footings and foundations and backfilled with sand or gravel to prevent structural damage caused by shrinking and swelling of the soil. Some land shaping generally is needed for small commercial buildings. Septic tank absorption fields generally will not function properly because of moderately slow permeability of the soil. Sewage lagoons will work if less sloping areas are available or the area can be leveled for a site. Also, more slowly permeable material may need to be added to seal the bottom of the lagoon to prevent seepage. Low strength is a limitation on sites for local roads and streets. However, this limitation can be corrected by strengthening the base with crushed rock or other suitable material. Grading the road to shed water and providing adequate side ditches and culverts help prevent damage caused by frost action and shrinking and swelling of the soil.

This soil is in capability subclass IIIe and in woodland group 2o.

26D2—Ladoga silt loam, 9 to 14 percent slopes, eroded. This is a deep, moderately well drained, strongly sloping soil on convex side slopes. Individual areas are generally long and narrow and range from 5 to 25 acres.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil, about 39 inches thick, is dark yellowish brown, firm silty clay loam that is mottled in the lower part. The substratum, to a depth of about 60 inches, is brown, mottled, friable silty clay loam. In places, the dark surface layer is more than 10 inches deep. In other places, the dark surface layer has eroded, and the present surface layer is dark yellowish brown silty clay loam.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of Armster and Snead soils. Armster soils have sand and gravel throughout and are on side slopes, in lower positions than the Ladoga soil. The Snead soils are moderately deep and are on side slopes, in lower positions.

Permeability is moderately slow, and surface runoff is rapid. Available water capacity is high. The soil ranges from medium acid to strongly acid in the most acid part. Natural fertility is medium, and content of organic matter is low. The surface layer is friable and can be tilled within a moderately wide range of moisture content. However, it becomes cloddy if tilled when wet and tends to crust or puddle after a hard rain. Shrink-swell potential is moderate in the subsoil.

In most areas this soil is used as pasture, hayland, and woodland. In a few areas it is used for cultivated crops. This soil is suited to corn, soybeans, small grain, and grain sorghum. If this soil is used for cultivated crops, erosion is a severe hazard. Diversion terraces, conservation tillage, winter cover crops, and grassed waterways help reduce erosion. Returning crop residue or regularly adding other organic material helps reduce erosion, improve fertility, and increase water infiltration.

This soil is suited to pasture or hay. Using the soil as pasture or hayland effectively controls erosion. Overgrazing or grazing when the soil is wet causes damage to the stand, surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the soil and pasture in good condition.

This soil is well suited to trees, and in a few small areas it remains in native hardwoods. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed, by site preparation, spraying, or cutting. There are no other hazards or limitations when planting or harvesting trees.

This soil is suited to building site development and onsite waste disposal. Septic tanks generally do not function properly because of the moderately slow permeability. Sewage lagoons generally can be located in the less sloping areas, or the soil can be leveled to prepare a site. Footings and foundations of dwellings should be adequately reinforced and backfilled with sand or gravel to prevent structural damage caused by shrinking and swelling. Some land shaping may be necessary, or dwellings can be designed to fit the natural slope of the land. Low strength is a limitation on sites for local roads and streets. This limitation can be overcome by adding crushed rock or other suitable base material. Grading roads to shed water and providing adequate side ditches and culverts help prevent damage caused by frost action and shrinking and swelling of the soil.

This soil is in capability subclass IIIe and in woodland group 2o.

30—Kennebec silt loam. This is a deep, nearly level, moderately well drained soil on bottom lands along the smaller streams. This soil is subject to frequent flooding. Individual areas are generally long and narrow and range from 10 to 60 acres.

Typically, the surface layer is very dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer, to a depth of about 60 inches, is very dark gray and black, friable silt loam.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of poorly drained Bremer and Colo soils. Bremer soils have more clay and are on low terraces adjacent to the uplands. Colo soils have more clay and are in areas between the Kennebec soils and the uplands.

Permeability is moderate, and surface runoff is slow. Available water capacity is very high. The soil generally is slightly acid to neutral, although in some areas the plow layer is medium acid. Natural fertility and content of organic matter are high. A seasonal high water table is at a depth of 3 to 5 feet from winter to early in summer. The surface layer is friable and can be tilled within a wide range of moisture content. Shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops, pasture, and hay. It is suited to corn, soybeans, grain sorghum, and other cultivated crops where flooding of short duration is not a hazard. Because of the shape and size of the areas, it is difficult to cultivate a large acreage of this soil. If this soil is used for cultivated crops, winter cover crops and residue management help protect the soil from scouring, maintain tilth, and increase water infiltration.

This soil is suited to pasture and hay crops. Flooding is not a limitation because floodwater generally covers the soil for less than a day. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and damages the stand. Fertilization, proper stocking rates, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is the only management concern. Plant competition for seedlings can be reduced by careful and thorough site preparation, including burning, spraying, or cutting. Release treatments may be necessary to ensure development.

This soil generally is not suited to building site development and onsite waste disposal because of the hazard of frequent flooding.

This soil is in capability subclass IIw and in woodland group 2o.

31—Colo silt loam. This is a deep, nearly level, poorly drained soil on bottom lands. This soil is subject to frequent flooding. Individual areas are irregular in shape and range from 20 to 150 acres.

Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsurface layer, to a depth of about 60 inches, is black, friable silty clay loam in the upper part and very dark gray, mottled, firm silty clay loam in the lower part. In places, the clay content is more than 35 percent.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of Dockery soils. The Dockery soils are somewhat poorly drained, have less clay, and are at the mouth of tributary streams.

Permeability is moderate, and surface runoff is slow. Available water capacity is high. The surface layer is neutral to medium acid, and the subsurface layer is neutral to slightly acid. Natural fertility and content of organic matter are high. The surface layer is friable and can be tilled within a moderately wide range of moisture content if the silty clay loam subsurface layer is not disturbed. Shrink-swell potential is high.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, grain sorghum, and small grains. The poor drainage and slow runoff can be improved by installing tile drainage or surface ditches. Wetness commonly delays planting in the spring. This limitation can be partially overcome by fall plowing or by planting short-season annual crops.

This soil is suited to hay and pasture. Wetness and flooding are the major limitations. These limitations can be minimized by installing tile drainage or surface ditches. Because this soil is wet, it tends to stay cold later in spring, thus delaying plant growth. Carefully planned pasture rotation and deferment of grazing help overcome this problem.

This soil generally is not suited to building site development and onsite waste disposal because of the hazard of flooding.

This soil is in capability subclass IIIw. It was not assigned to a woodland group.

36—Bremer silt loam. This is a deep, nearly level, poorly drained soil on low stream terraces. This soil is subject to occasional flooding. Individual areas are irregular in shape and range from 20 to 80 acres.

Typically, the surface layer is black, friable silt loam about 9 inches thick. The subsurface layer is black silty clay loam about 8 inches thick. The subsoil is about 42 inches thick. The upper part is black, firm silty clay loam; the middle part is very dark gray, mottled, firm silty clay loam; and the lower part is dark gray, mottled, firm silty clay loam. The substratum, to a depth of about 64 inches, is mottled, gray and dark grayish brown, friable silty clay loam. In places, the subsoil has less clay.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of Kennebec soils. The moderately well drained Kennebec soils have less clay and are in small drainageways coming out of the upland onto or through Bremer terraces.

Permeability is moderately slow, and surface runoff is slow. Available water capacity is high. The reaction is neutral in the surface soil and slightly acid below. Natural fertility and organic matter content are high. The seasonal high water table is at a depth of 1 foot to 2 feet. This soil can only be tilled within a rather narrow range of moisture content. If tilled when too wet it will be cloddy. Shrink-swell potential is high in the subsoil.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, grain sorghum, and small grains. The poor drainage and slow runoff can be improved, and the hazard of damage from flooding reduced, by the use of surface drainage ditches. Wetness generally delays tillage in spring. This limitation can be partially overcome by fall plowing or by planting short-season annual crops.

This soil is suited to use as pasture and hayland. Wetness and the hazard of flooding are the major management concerns. Surface drainage ditches can help minimize these problems. Because these soils are wet, they tend to stay cold later in spring, thus delaying plant growth. Carefully planned pasture rotation and deferment of grazing help overcome this limitation.

This soil is suited to trees. Equipment use is limited, and windthrow is a hazard. Plant competition and seedling mortality are management concerns. Equipment should be used when the soil is dry or frozen. Using special planting stock that is larger than usual or containerized stock may be necessary to increase the chance of survival. Ridging the soil and planting on the ridges help increase the chance of seedling survival. Less intensive, more frequent thinnings may be necessary to reduce the hazard of windthrow damage. Plant competition for seedlings can be reduced by careful and thorough site preparation, including burning, spraying, or cutting. Release treatments may be necessary to ensure development.

This soil generally is not suited to building site development and onsite waste disposal because of the hazard of occasional flooding.

This soil is in capability subclass IIw and in woodland group 3w.

38—Wiota silt loam. This is a deep, nearly level, well drained soil on stream terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from 20 to 80 acres.

Typically, the surface layer is black, friable silt loam about 7 inches thick. The subsurface layer is black, friable silty clay loam about 15 inches thick. The subsoil is about 33 inches thick. The upper part is very dark grayish brown, friable silty clay loam; the middle part is brown, firm silty clay loam; and the lower part is dark yellowish brown, firm silty clay loam. The substratum, to a depth of about 71 inches, is dark yellowish brown, firm silty clay loam. In places, grayish brown mottles are above a depth of 36 inches. Generally a steep escarpment is adjacent to the bottom land (fig. 9).

Included with this soil in mapping are small areas of moderately well drained Kennebec soils and moderately sloping Knox soils. The Kennebec soils are along the stream channels on the lower side of the terrace. The Knox soils are on the upper side of the terrace where it merges with the uplands. The included soils make up 5 to 10 percent of the map unit.

Permeability is moderate, and surface runoff is medium. Available water capacity is very high. The soil ranges from slightly acid to strongly acid. Natural fertility is high, and content of organic matter is moderate. The surface layer is friable and is easily tilled within a moderately wide range of moisture conditions. However, it tends to crust or puddle after a hard rain. Shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, sorghum, and small grains. Limitations are slight.

This soil is suited to use as pasture and hayland. It is well suited to alfalfa and most other legumes and grasses. Overgrazing or grazing when the soil is wet can cause surface compaction and poor tilth and damage the

Figure 9.—Escarpment adjacent to bottom land, in an area of Wiota silt loam.

stand. Fertilization, proper stocking rates, pasture rotation, and timely deferment of grazing help maintain maximum production and extend the life of the stand.

This soil generally is not suited to building site development and onsite waste disposal because of the hazard of rare flooding.

This soil is in capability class I. It was not assigned to a woodland group.

39—Nodaway silt loam. This is a deep, nearly level, moderately well drained soil on bottom lands. This soil is subject to frequent flooding of short duration. Individual areas are irregular in shape and range from 80 to 300 acres.

Typically, the surface layer is stratified very dark grayish brown and very dark gray, friable silt loam about 6 inches thick. The substratum, to a depth of about 60 inches, is stratified dark grayish brown, grayish brown, black, and very dark gray, friable silt loam.

Included with this soil in mapping are small areas of Kennebec and Wiota soils. Kennebec soils have a thicker dark surface layer and are in areas where small upland streams empty into the larger stream valleys. Wiota soils are well drained, have a thicker dark surface layer, and are on terraces.

Permeability is moderate, and surface runoff is slow. Available water capacity is very high. The soil ranges from slightly acid to neutral. Natural fertility is high, and content of organic matter is moderate. A seasonal high water table is at a depth of 3 to 5 feet in winter. The surface layer is friable and can be tilled within a wide range of moisture content. Shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, grain sorghum, and small grains where flooding of short duration is not a hazard. If this soil is used for cultivated crops, flooding and wetness sometimes delay tillage in spring. Fall plowing can subject the soil to scouring during flooding.

This soil is suited to hay and pasture. Flooding is not a serious limitation, because the flooding is generally of short duration. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and damages the stand. Fertilization, proper stocking rates, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees, and in a few areas it is still native woodland. Cuttings and seedlings survive and grow well if competing vegetation is controlled or removed, by thorough site preparation, spraying, or cutting. There are no serious limitations to harvesting or planting.

This soil generally is not suited to building site development and onsite waste disposal because of the hazard of frequent flooding.

This soil is in capability subclass IIw and in woodland group 2o.

41D2—Armster loam, 8 to 14 percent slopes, eroded. This is a deep, strongly sloping, moderately well drained soil on convex side slopes. Individual areas are irregular in shape and range from 15 to 80 acres.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsoil is more than 53 inches thick. The upper part is dark brown, friable clay loam; the middle part is reddish brown, firm clay; and the lower part is yellowish brown, mottled, firm clay. In places, plowing has mixed the upper part of the subsoil with the surface layer, and the present surface layer is dark yellowish brown clay loam. In places, the slope is less than 8 percent.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of moderately deep Snead soils and a few areas of Rock outcrop in lower positions on the side slopes.

Permeability is moderately slow, and surface runoff is rapid. Available water capacity is moderate. The upper part of the subsoil ranges from slightly acid to very strongly acid, and the lower part ranges from slightly acid to mildly alkaline. Natural fertility is medium, and content of organic matter is moderately low. A seasonal high water table is at a depth of 3 to 5 feet. The surface layer is friable and is easily tilled within a fairly wide range of moisture conditions. It does, however, have a tendency to crust or puddle after a hard rain, especially in areas where plowing has mixed subsoil material with the surface layer. The shrink-swell potential is high.

In most areas this soil is used for pasture and hay. It is not well suited to cultivated crops, although in some areas it is used for soybeans and grain sorghum. If this soil is used for cultivated crops, further erosion is a severe hazard. Properly designed terraces and waterways, conservation tillage, and winter cover crops help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps improve fertility, reduce crusting, improve water infiltration, and prevent erosion.

Using the soil as pastureland or hayland effectively controls erosion. This soil is suited to alfalfa and most other legumes and grasses. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees, and in a few areas it remains in native hardwoods. The hazards and limitations for planting or harvesting trees are slight.

This soil is suited to building site development and onsite waste disposal. Septic tank absorption fields generally do not function properly because of the moderately slow permeability. Sewage lagoons can be located in less sloping areas, or the area can be leveled to prepare a site. The bottom of the lagoon can be sealed to prevent seepage. Basements and foundations for dwellings should be adequately reinforced and backfilled with sand or gravel to prevent structural damage caused by shrinking and swelling of the soil. Installing tile drains around footings and foundations helps prevent damage from excessive wetness. Low strength is a limitation on sites for local roads and streets. However, this limitation can be overcome by adding crushed rock or other suitable base material. Grading roads to shed water and providing adequate side ditches and culverts help prevent damage caused by frost action, wetness, and shrinking and swelling of the soil.

This soil is in capability subclass IVe and in woodland group 4o.

48D—Basehor loam, 5 to 14 percent slopes. This is a shallow, moderately sloping to strongly sloping, well drained soil on uplands. Individual areas are irregular in shape and range from 10 to 40 acres.

Typically, the surface layer is very dark grayish brown loam about 4 inches thick. The subsoil is about 9 inches thick. In the upper part it is brown, friable loam, and in the lower part it is dark yellowish brown, friable fine sandy loam. Soft, strong brown sandstone is at a depth of about 13 inches.

Included with this soil in mapping, and making up less than 5 percent of the map unit, are small areas of deep Higginsville and Knox soils. Higginsville and Knox soils are upslope from the Basehor soils.

Permeability is moderately rapid, and surface runoff is medium. Available water capacity is low. The soil ranges from medium acid to strongly acid, except for the surface layer, which commonly is slightly acid. Natural fertility and content of organic matter are low. Shrink-swell potential is low.

In most areas this soil is in woodland. This soil is suited to trees. Shallow rooting depth and low available water capacity limit growth; seedling mortality and windthrow are management concerns. Because of low production, managing woodland for commercial production is generally not feasible. However, the trees are of sufficient size to be used for firewood. Protection from grazing and removal of undesirable species reduces seedling mortality and increases production.

This soil is suited to pasture. It can be used for warm season grasses. Shallow rooting depth commonly causes droughtiness and limits production. Overgrazing causes surface compaction, increases runoff, and damages the stand. Fertilization, proper stocking rates, pasture rotation, and timely deferment of grazing help production, increase water infiltration, and keep the pasture and soil in good condition.

This soil generally is not suited to cultivated crops.

This soil generally is not suited to building site development and onsite waste disposal because of shallow depth to bedrock.

This soil is in capability subclass VIe and in woodland group 5d.

54C2—Knox silt loam, 5 to 9 percent slopes, eroded. This is a deep, moderately sloping, well drained soil on ridgetops on the strongly dissected river hills and bluffs bordering the Missouri River and its tributaries. Individual areas of this unit are generally long and narrow and range from 15 to 60 acres.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is dark yellowish brown, friable silty clay loam about 39 inches thick. The substratum, to a depth of about 60 inches, is dark yellowish brown, friable silt loam. In places, the slope is less than 5 percent. In a few areas, the surface layer is very dark grayish brown, and there is a dark grayish brown subsurface layer about 4 inches thick.

Included with this soil in mapping are a few Rock outcrops and some small areas of moderately well drained Sharpsburg and well drained Sibley soils. The Rock outcrops are on side slopes, in lower positions than the Knox soil. The Sharpsburg and Sibley soils have a thick dark surface layer and are on ridgetops, upslope from the Knox soil. The inclusions make up about 5 to 10 percent of the map unit.

Permeability is moderate, and surface runoff is medium. Available water capacity is very high. The subsoil ranges from medium acid to neutral; the surface layer varies according to local liming practices. Natural fertility is high, and content of organic matter is low. The surface layer is friable and easily tilled. However, it tends to puddle or crust after a hard rain. The subsoil has moderate shrink-swell potential.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, grain sorghum, small grains, and other cultivated crops. If the soil is used for cultivated crops, further erosion is a hazard. Conservation tillage, stripcropping, winter cover crops, and grassed waterways help prevent excessive soil loss. In most areas this soil is suited to terraces and contour cultivation. Returning crop residue or adding other organic material helps improve water infiltration, improve fertility, and reduce crusting.

Using the soil for pasture and as hayland effectively controls erosion. This soil is suited to alfalfa and most other legumes and grasses. Overgrazing or grazing when the soil is wet damages the stand and causes surface compaction and excessive runoff. Fertilization, proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. In a few small areas it is in native hardwoods. There are no hazards or limitations in planting or harvesting trees. This soil is well suited to orchards, and a small acreage is used for the production of apples and peaches.

This soil is suitable for building site development and for onsite waste disposal. The moderate shrink-swell potential is a limitation for dwellings. Backfilling with sand and gravel around footings and foundations helps prevent structural damage caused by the shrinking and swelling of the soil. This soil is suitable for septic tanks if proper design and installation procedures are used. Seepage is a limitation for sewage lagoons. This limitation can be overcome by sealing the bottom of the lagoon with slowly permeable material. Low strength and frost action are limitations for local roads and streets. These limitations can be overcome by adding crushed rock or other suitable base material and providing adequate drainage, including side ditches and culverts.

This soil is in capability subclass IIIe and in woodland group 3o.

54F2—Knox silt loam, 20 to 30 percent slopes, eroded. This is a deep, steep, well drained soil on side slopes on strongly dissected river hills and bluffs bordering the Missouri River and its tributaries. Individual areas of this map unit are irregular in shape and range from 20 to 200 acres.

Typically, the surface layer is very dark grayish brown, friable silt loam about 6 inches thick. The subsoil is dark yellowish brown, friable silty clay loam about 31 inches thick. The substratum, to a depth of about 60 inches, is dark yellowish brown, friable silt loam.

Included with this soil in mapping, and making up about 10 percent of the map unit, are small areas of Armster and Kennebec soils and narrow bands of Rock outcrop. Armster soils are redder and have more sand than the Knox soil and are slightly higher than the Rock outcrop. Kennebec soils are darker throughout than the Knox soil and are in narrow stream bottoms. The Rock outcrop is downslope from Knox soils or in narrow bands within areas of Knox soils.

Permeability is moderate, and surface runoff is very rapid. Available water capacity is high. Reaction ranges from medium acid to neutral. Natural fertility is high, and content of organic matter is low. The subsoil has moderate shrink-swell potential.

This soil is suited to trees, and in most areas it remains in native hardwoods. Erosion hazard, equipment limitation, and seedling mortality are management concerns. Erosion can be controlled by locating roads and skid trails on the contour to minimize the length and steepness of the slope. Yarding logs uphill to roads and skid trails for safe operation of equipment may be necessary in steep areas. Seeding may be needed in disturbed areas after harvesting.

This soil is suited to pasture and hay. Using the soil for pasture and hay effectively controls erosion, if a good plant stand is maintained. Overgrazing or grazing when the soil is wet damages the stand and causes surface compaction and excessive runoff. Fertilization, proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition. Conservation tillage should be used when reseeding pastures, in order to ensure adequate cover during rainy seasons and in winter.

This soil generally is not suited to use for cultivated crops because of the severe hazard of erosion.

This soil generally is not suited to building site development and onsite waste disposal because of steep slopes.

This soil is in capability subclass VIe and in woodland group 3r.

55D3—Knox silty clay loam, 5 to 14 percent slopes, severely eroded. This is a deep, moderately sloping and strongly sloping, well drained soil on side slopes of the strongly dissected river hills and bluffs bordering the Missouri River and its tributaries. Individual areas are irregular in shape and range from 10 to 200 acres.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 5 inches thick. The subsoil is about 42 inches thick. The upper part is dark brown, friable silty clay loam, and the lower part is dark yellowish brown, friable silty clay loam. The substratum, to a depth of about 60 inches, is dark yellowish brown, friable silt loam. In places, part of the original surface layer remains; it is very dark grayish brown silt loam.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are narrow bands of Rock outcrop and small areas of moderately well drained Sharpsburg and Sibley soils. The Rock outcrop is in narrow bands in low positions on the side slopes. Sharpsburg and Sibley soils have a thick dark colored surface layer and are on ridgetops upslope from this Knox soil. Sharpsburg soils are in small concave drainage areas intermingled with areas of the Knox soil.

Permeability is moderate, and surface runoff is rapid. Available water capacity is high. The subsoil ranges from medium acid to neutral. The surface layer varies in reaction according to local liming practices. Natural fertility is medium, and content of organic matter is low. The surface layer is friable and is easily tilled. However, it does have a tendency to puddle or crust after a hard rain. Shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops. This soil generally is suited only to a limited amount of cultivated crops and also is suited to pasture, hay, and trees. Using the soil as pasture or hayland effectively controls erosion. This soil is suited to alfalfa and most other legumes. Overgrazing or grazing when the soil is wet damages the stand and causes surface compaction and excessive runoff. Fertilization, proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees, and in a few small areas it remains in native hardwoods. There are no hazards or limitations when planting or harvesting trees.

This soil is suited to building site development and onsite waste disposal. Slope, shrink-swell potential, and seepage are limitations for dwellings, absorption fields, and sewage lagoons. Dwellings can be constructed on less sloping areas or designed to fit the natural slope. Some land shaping may be necessary. Backfilling with sand and gravel around the foundation or basement wall will help prevent structural damage caused by shrinking and swelling of the soil. Septic tanks or sewage lagoons can be constructed on less sloping, more suitable areas. Areas can be leveled for lagoons. Slowly permeable material can be used to seal the bottom of the lagoon to prevent seepage. Absorption fields can be designed to fit the natural slope of the land. If this soil is used for local roads and streets, the base needs to be strengthened by adding crushed rock or other suitable material. Damage caused by frost action can be prevented by providing adequate drainage, using side ditches and culverts.

This soil is in capability subclass IVe and in woodland group 3o.

55E3—Knox silty clay loam, 14 to 20 percent slopes, severely eroded. This is a deep, moderately steep, well drained soil on side slopes of the strongly dissected river hills and bluffs bordering the Missouri River and its tributaries. Individual areas are irregular in shape and range from 5 to 60 acres.

Typically, the surface layer is brown, friable silty clay loam about 4 inches thick. The subsoil is about 28 inches thick. The upper part is dark yellowish brown, friable silty clay loam, and the lower part is brown, friable silty clay loam. The substratum, to a depth of about 60 inches, is yellowish brown silt loam. In places, part of the original surface layer remains; it is very dark grayish brown silt loam.

Included with this soil in mapping, and making up 5 percent of the unit, are small areas of Armster and Kennebec soils and narrow bands of Rock outcrop. Armster soils have more clay and sand and are in slightly higher positions than the Rock outcrop. Kennebec soils have a thick dark surface layer and are in narrow stream bottoms. The Rock outcrop is downslope from the Knox soil or is in narrow bands within areas of the Knox soil.

Permeability is moderate, and surface runoff is rapid. Available water capacity is very high. The subsoil ranges from medium acid to neutral. The surface layer varies in reaction according to local liming practices. Natural fertility is medium, and content of organic matter is low. The surface layer is friable; however, it has only a moderately wide moisture range for good tillage. If tilled when wet this soil becomes cloddy. Shrink-swell potential is moderate.

In most areas this soil is used as permanent pasture. This soil generally is not suited to cultivated crops. It is suited to pasture, hay, and trees. Using the soil as pasture and hayland effectively controls erosion. This soil is suitable for alfalfa and most other legumes. Overgrazing or grazing when the soil is wet damages the stand and causes surface compaction and excessive runoff. Fertilization, proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is suited to trees, and in some areas it remains in native hardwoods. Erosion hazard, equipment limitation, and seedling mortality are concerns of management. Erosion can be controlled by locating roads and skid trails on the contour to minimize length and steepness of slope. These moderately steep areas may require yarding logs uphill to roads and skid trails for safe operation of equipment. Seeding disturbed areas may be necessary after harvesting is completed.

Slope is a limitation for building site development and onsite waste disposal. In some areas this soil can be extensively reshaped, or dwellings, absorption fields, and local roads and streets can be designed and constructed to fit the natural lay of the land. In places, sewage can be piped to adjacent, more suitable soils. Adding crushed rock or other suitable base material to roads helps overcome low strength. Grading roads to shed water helps prevent damage caused by frost action.

This soil is in capability subclass VIe and in woodland group 3r.

61C—Knox-Urban land complex, 5 to 9 percent slopes. This map unit consists of deep, moderately sloping, well drained Knox soils on narrow convex ridges and Urban land. Individual areas are long and narrow in shape and range from 25 to 150 acres in size. About 60 percent is Knox soils, 35 percent Urban land, and 5 percent soils of minor extent. Areas of Knox soils and Urban land are so intricately intermingled that it was not practical to map them separately.

Typically, the surface layer of the Knox soils is dark brown silt loam about 8 inches thick. The subsoil is dark yellowish brown, friable silty clay loam about 28 inches thick. The substratum, to a depth of about 60 inches, is dark yellowish brown, friable silt loam. In places the surface layer has been removed because of land shaping. In other places dark yellowish brown fill material has been graded in over the original soil.

Urban land is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that a series designation is not feasible.

Permeability is moderate in the Knox soils. The Urban land is impervious to water penetration. Surface runoff is medium to rapid. The Knox soils are high in natural fertility and moderately low in content of organic matter. Available water capacity is very high. The subsoil of the Knox soils has moderate shrink-swell potential.

The Knox soils in this map unit are in open areas around buildings, parks, playgrounds, gardens, and in random undeveloped areas. They are well suited to use for lawn grasses, shade and ornamental trees, shrubs, vines, and vegetable gardens. This map unit is suited to recreational uses that can be adapted to the size and shape of the open areas. In some areas land shaping may be needed if the soils are to be used for campgrounds, playgrounds, and picnic areas.

Dwellings should have adequately reinforced footings and foundations in order to prevent damage caused by the shrinking and swelling of the soil. Septic tanks and sewage lagoons function adequately if the site is leveled. The bottom of a sewage lagoon should be sealed with slowly permeable material to prevent seepage. Low strength, frost action, and shrink-swell potential are limitations for streets. Adding crushed rock or other suitable base material helps prevent damage caused by low strength. Grading the roads to shed water and providing adequate culverts and side ditches, or tile drains and storm sewers, help prevent damage caused by frost action and the shrinking and swelling of the soil.

This map unit was not assigned to a capability subclass or a woodland group.

61D—Knox-Urban land complex, 9 to 14 percent slopes. This map unit consists of deep, strongly sloping, well drained Knox soil on convex side slopes and Urban land. Individual areas are irregular in shape and range from 15 to 450 acres. They are about 65 percent Knox soil, 30 percent Urban land, and 5 percent included soils. Areas of the Knox soil and Urban land form such an intricate pattern that it was not practical to map them separately.

Typically, the surface layer of the Knox soil is dark grayish brown, friable silty clay loam about 5 inches thick. The subsoil is about 42 inches thick. The upper part is dark brown, friable silty clay loam, and the lower part is dark yellowish brown, friable silty clay loam. The substratum, to a depth of about 60 inches, is dark yellowish brown, friable silt loam. In places, dark yellowish brown fill material has been graded in on top of the original soil during land shaping. In other places, the subsoil has more clay.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification of the soil series is not feasible.

Included in mapping, and making up less than 5 percent of the map unit, are small areas of Snead soils. The Snead soils are moderately deep and are in lower positions on side slopes.

Permeability is moderate in the Knox soil. The Urban land is impervious to water penetration. The surface runoff on this unit is rapid. The Knox soil is medium in natural fertility and low in content of organic matter. Available water capacity is high. The shrink-swell potential of the Knox soil is moderate.

The Knox soil is in yards, open areas around buildings, parks, playgrounds, gardens, and in random undeveloped areas. It is well suited to lawn grasses, shade and ornamental trees, shrubs, vines, and gardens. This unit is suited to those recreation uses that can be adapted to the limited size and shape of the open space areas. Areas used for campgrounds, picnic areas, and playgrounds may need some land shaping or leveling to reduce the slope.

Dwellings should be designed and constructed with adequate reinforcement in footings and foundations to prevent damage caused by shrinking and swelling of the soil. Septic tanks will function; however absorption lines should be installed across the slope. Sewage lagoons can be built if the area is reshaped and leveled. The bottom of the lagoon should be sealed with slowly permeable material. Low strength, frost action, and shrink-swell potential are limitations for streets. Adding crushed rock or other suitable base material will help prevent damage caused by low strength. Grading the roads to shed water and providing adequate culverts and side ditches, or tile drains and storm sewers, will help prevent damage caused by frost action and shrinking and swelling of the soil.

This map unit was not assigned to a capability subclass or woodland group.

72—Dockery silt loam. This is a deep, nearly level, somewhat poorly drained soil on bottom lands. This soil is subject to frequent flooding. Individual areas are irregular in shape and range from 80 to 300 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The substratum, to a depth of about 64 inches, is stratified, very dark grayish brown, dark grayish brown, grayish brown, very dark gray, and dark gray, friable silt loam.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of moderately well drained Kennebec and Nodaway soils. Kennebec soils are on areas where smaller streams empty into the larger stream flood plain. Nodaway soils are closer to the stream channel.

Permeability is moderate, and surface runoff from cultivated areas is slow. The substratum ranges from slightly acid to neutral; the surface layer varies in reaction according to local liming practices. Natural fertility is high, and content of organic matter is moderate. Available water capacity is very high. A seasonal high water table is at a depth of 2 to 3 feet in winter and spring. The surface layer is friable and is easily tilled within a fairly wide range of moisture content. Shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, small grains, and grasses and legumes for pasture and hay. If the soil is used for cultivated crops, wetness is a problem in places. Land grading, shallow surface drains, and open ditches help remove excess water. Field drain tile will help remove excess water in the soil. Returning crop residue or regularly adding other organic material helps improve fertility, reduce crusting, and increase water infiltration.

If this soil is used as pastureland or hayland, shallow-rooted legumes and grasses that tolerate wetness should be used. Overgrazing or grazing when the soil is wet causes surface compaction, poor tilth, and a decrease in water infiltration. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. The management concerns for woodland production are slight.

This soil generally is not suited to building site development and onsite waste disposal because of the hazard of frequent flooding.

This soil in in capability subclass IIIw and in woodland group 3o.

73—Leta silty clay. This is a deep, nearly level, somewhat poorly drained soil on bottom lands of the Missouri River. This soil is subject to occasional flooding unless protected. Individual areas are irregular in shape and range from 20 to 100 acres.

Typically, the surface layer is black, firm silty clay about 3 inches thick. The subsurface layer is very dark brown silty clay about 8 inches thick. The subsoil, about 13 inches thick, is dark grayish brown, mottled, firm silty clay loam. The substratum, to a depth of about 60 inches, is stratified grayish brown, mottled, friable very fine sandy loam. In places, loamy material is at a depth of less than 20 inches.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of moderately well drained Haynie soils. Haynie soils are in slightly higher positions than the Leta soil.

Permeability is slow in the upper part, which is clayey, and moderate in the lower part, which is loamy. Surface runoff is slow. Available water capacity is high. Natural fertility is high, and content of organic matter is moderate. A seasonal high water table is at a depth of 1 to 3 feet. Reaction ranges from mildly alkaline to moderately alkaline. The surface layer is very firm when dry and sticky when wet. Tillage needs to be carefully timed. The soil becomes cloddy unless it is tilled at the proper moisture content. Shrink-swell potential is high in the surface layer and subsoil and low in the substratum.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, small grains, and grasses for pasture or hay. Wetness is a hazard when this soil is used for cultivated crops. Open ditches, shallow surface drains, and land grading help remove excess water. Returning crop residue or regularly adding other organic material helps increase fertility, improve tilth, and increase water infiltration.

This soil is suited to trees. Equipment use is limited, and seedling mortality is a management concern. Equipment should be used when the soil is dry or frozen. Planting special stock that is larger than usual or containerized stock may be necessary to increase the chance of seedling survival. Ridging the soil and planting on the ridges help increase the chance of survival.

This soil generally is not suited to onsite waste disposal and building site development because of the hazard of occasional flooding.

This soil in in capability subclass IIw and in woodland group 3c.

74—Levasy silty clay. This is a deep, nearly level, poorly drained soil in slightly concave depressions on bottom lands of the Missouri River. This soil is subject to ponding and to occasional flooding unless protected. Individual areas are irregular in shape and range from 20 to 100 acres.

Typically, the surface layer is very dark gray, firm silty clay about 6 inches thick. The subsurface layer, to a depth of about 29 inches, is very dark grayish brown, mottled, firm silty clay in the upper part and dark grayish brown, mottled firm silty clay in the lower part. The substratum, to a depth of about 60 inches, is stratified grayish brown, mottled, very friable very fine sandy loam.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of moderately well drained Haynie soils and somewhat poorly drained Parkville soils. Haynie soils are in slightly higher positions than the Levasy soils. Parkville soils are in shallow depressions, slightly higher than the Levasy soil.

Permeability is slow in the surface layer and moderate in the substratum. Runoff is very slow or ponded. Available water capacity is high. Reaction is mildly alkaline to neutral. Natural fertility is medium, and content of organic matter is moderate. A seasonal high water table is 1.0 foot above the surface to 1.5 feet below in winter and spring. The surface layer is very firm when dry and sticky when wet. Tillage must be carefully timed. Shrink-swell potential is high in the upper part, which is clayey, and low in the lower part, which is loamy.

In most areas this soil is used for row crops. It is suited to corn, soybeans, and small grains. Wetness is the major problem. Open ditches, shallow surface drains, and land grading help remove excess water. Returning crop residue or regularly adding other organic material helps improve fertility, reduce crusting, improve tillage, and increase water infiltration.

This soil is suited to trees. Equipment use, seedling mortality, and plant competition are management concerns. Equipment operations should be timed for periods when the soil is dry or frozen. Planting special stock of a larger size than usual or containerized stock may be necessary to achieve better survival. Ridging the soil and planting on the ridges help to increase seedling survival. Plant competition for seedlings can be reduced by careful and thorough site preparation. This may include prescribed burning, spraying, or cutting. Release treatments may be necessary to ensure development.

This soil generally is not suited to building site development and onsite waste disposal because of the hazard of occasional flooding.

This soil is in capability subclass IIIw and in woodland group 3w.

81—Waldron silty clay loam. This is a deep, nearly level, somewhat poorly drained soil in low slightly concave depressions on bottom lands of the Missouri River. This soil is subject to occasional flooding unless protected. Individual areas are irregular in shape and range from 20 to 80 acres.

Typically, the surface layer is very dark grayish brown, firm silty clay loam about 8 inches thick. The substratum, to a depth of about 60 inches, is dark grayish brown, mottled, firm silty clay loam in the upper part and dark gray, mottled, firm silty clay loam in the lower part.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of Levasy, Leta, and Parkville soils. Levasy soils are poorly drained, have silty clay over sandy loam, and are in somewhat lower areas than the Waldron soil. Leta and Parkville soils have silty clay and silty clay loam over fine sandy loam and are in slightly higher areas.

Permeability is slow, and runoff is slow. Available water capacity is moderate. Reaction ranges from neutral to moderately alkaline. Natural fertility is medium, and content of organic matter is moderate. A seasonal high water table is at a depth of 1 to 3 feet. The surface layer is firm and sticky when wet. Tillage needs to be carefully timed. The soil becomes cloddy if tilled when too wet or dry. Shrink-swell potential is moderate in the surface layer and high in the substratum.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, and small grains. Wetness is the major problem. Open ditches, shallow surface drains, and land grading is needed to remove excess water. Returning crop residue or regularly adding other organic material helps improve fertility, reduce crusting, improve tillage, and increase water infiltration.

This soil is suited to hay and pasture. Wetness is the major problem. Using open ditches for drainage and land grading help overcome this problem. Shallow-rooted legumes and grasses that tolerate wetness should be used. Careful management is needed to avoid overgrazing or grazing when the soil is wet. Proper stocking rates, fertilization, and pasture rotation help keep the pasture and soil in good condition.

This soil is suited to trees. Equipment use is limited, and seedling mortality is a management concern. Equipment should be used when the soil is dry or frozen. Planting special stock that is larger than usual or containerized stock helps increase the chance of survival.

This soil generally is not suited to building site development and onsite waste disposal because of the hazard of occasional flooding.

This soil is in capability subclass IIw and in woodland group 2c.

82—Parkville silty clay loam. This is a deep, nearly level, somewhat poorly drained soil in slightly concave depressed areas on bottom lands of the Missouri River. This soil is subject to occasional flooding unless protected. Individual areas are irregular in shape and range from 20 to 80 acres.

Typically, the surface layer and subsurface layer are very dark grayish brown, firm silty clay loam about 16 inches thick. The substratum, to a depth of about 60 inches, is dark grayish brown, very friable very fine sandy loam and silt loam.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of moderately well drained Haynie soils and poorly drained Levasy soils. Haynie soils are in slightly higher positions than the Parkville soil. Levasy soils are in the lowest part of the depressions, and their surface layer is more than 20 inches thick.

Permeability is slow in the upper part and moderate in the lower part. Surface runoff is slow. Available water capacity is high. Natural fertility is medium, and content of organic matter is moderate. Reaction is neutral to moderately alkaline. A seasonal high water table is at a depth of 1 to 2 feet in winter and spring. The surface layer is very firm when dry and sticky when wet. Tillage must be carefully timed. Shrink-swell potential is moderate in the surface layer and low in the substratum.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, grain sorghum, and small grains. Wetness is the major problem. Shallow surface ditches or land grading help overcome this problem. Returning crop residue or regularly adding other organic material helps improve fertility, reduce crusting, improve tillage, and increase water infiltration.

This soil is suited to trees. Equipment use is limited, and seedling mortality and plant competition are management concerns. Equipment should be used when the soil is dry or frozen. Planting special stock of a larger size than usual or containerized stock helps increase the chance of survival. Ridging the soil and planting on the ridges also help increase the chance of seedling survival. Plant competition for seedlings can be reduced by careful and thorough site preparation, including burning, spraying, or cutting. Release treatments may be necessary to ensure development.

This soil generally is not suited to building site development and onsite waste disposal because of the hazard of occasional flooding.

This soil is in capability subclass IIw and in woodland group 2c.

84—Haynie silt loam, clayey substratum. This is a deep, nearly level, moderately well drained soil on slightly convex ridges on bottom lands of the Missouri River. This soil is subject to occasional flooding unless protected. Individual areas are irregular in shape and range from 20 to 80 acres.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 9 inches thick. The substratum, to a depth of about 54 inches, is grayish brown, friable very fine sandy loam in the upper part; brown, mottled, friable very fine sandy loam in the middle part; and stratified, mottled, grayish brown and brown, friable very fine sandy loam in the lower part. Below a depth of 54 inches, the substratum is mottled dark grayish brown firm silty clay loam. In places, the surface layer is very fine sandy loam or silty clay loam.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of somewhat poorly drained Parkville soils and excessively drained Sarpy soils. Parkville soils are in small low depressions, and Sarpy soils are on higher sand ridges.

Permeability is moderate, and surface runoff is slow. Available water capacity is high. Natural fertility is high, and content of organic matter is moderately low. A seasonal high water table is at a depth of 4 to 6 feet. The surface layer is friable and easily tilled.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, grain sorghum, and small grains. Flooding can cause some crop losses, although it is not a major problem. Returning crop residue or regularly adding other organic material helps improve fertility, improve tillage, and increase water infiltration.

This soil is suited to hay and pasture. It is well suited to alfalfa and smooth bromegrass. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and damages the stand. Fertilization, proper stocking rates, pasture rotation, and timely deferment of grazing help keep the stand and soil in good condition.

This soil is suited to trees. Plant competition is the only management concern. Plant competition for seedlings can be reduced by careful and thorough site preparation, including burning, spraying, or cutting. Release treatments may be necessary to ensure development.

This soil generally is not suited to building site development and onsite waste disposal because of the hazard of occasional flooding.

This soil is in capability class I and in woodland group 1o.

86—Haynie Variant silt loam. This is a deep, nearly level, somewhat poorly drained soil in broad flat areas on bottom lands of the Missouri River. This soil is subject to occasional flooding unless protected. Individual areas are irregular in shape and range from 20 to 100 acres.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The substratum, to a depth of about 29 inches, is dark grayish brown, friable silt loam that has thin layers of very fine sand. To a depth of about 60 inches, it is grayish brown, mottled friable silt loam that has thin layers of very fine sand. In places, the substratum is silty clay loam below a depth of 50 inches.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of moderately well drained Haynie and Parkville soils. The Haynie soils are on long narrow ridges. The Parkville soils have silty clay over fine sandy loam and are in lower depressional areas.

Permeability is moderate, and surface runoff is slow. Available water capacity is very high. Natural fertility is high, and content of organic matter is low. A seasonal high water table is at a depth of 2 to 3 feet. The surface layer is friable and is easily tilled. Shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops. It is suited to corn, soybeans, grain sorghum, and small grains. Flooding can cause some crop losses, but is not a major problem. Returning crop residue or regularly adding other organic material helps improve fertility and increase water infiltration.

This soil is suited to trees. Plant competition is the only management concern. Plant competition for seedlings can be reduced by careful and thorough site preparation, including burning, spraying, or cutting. Release treatments may be necessary to ensure development.

This soil generally is not suited to building site development and onsite waste disposal because of the hazard of occasional flooding.

This soil is in capability subclass IIw and in woodland group 1o.

99—Sarpy fine sandy loam. This is a deep, nearly level, excessively drained soil on low convex ridges on bottom lands of the Missouri River. This soil is subject to occasional flooding unless protected. Individual areas are long and narrow and range from 10 to 40 acres.

Typically, the surface layer is very dark grayish brown, very friable fine sandy loam about 3 inches thick. The subsurface layer is very dark grayish brown, very friable fine sand 3 inches thick. The substratum, to a depth of about 60 inches, is grayish brown fine sand and dark grayish brown loamy fine sand. In places, the slopes are more than 2 percent.

Included with this soil in mapping, and making up 5 to 10 percent of the map unit, are small areas of well drained Haynie soils and somewhat poorly drained Parkville soils. Haynie soils are on lower, less sandy ridges, and Parkville soils are in depressional areas.

Permeability is rapid, and surface runoff is slow. Available water capacity is low. Natural fertility and content of organic matter are low.

In some areas this soil is used for soybeans. In some areas it is idle. This soil generally is not suited to cultivated crops, pasture, or hay because of droughtiness. However, it is suited to alfalfa. Fertilizing, cutting by early bloom stage, and leaving at least 6 inches of growth going into the winter help keep the stand in good condition.

This soil is suited to trees. Seedling mortality is the only management concern. Using special planting stock that is larger than usual or containerized stock helps increase the chance of survival.

This soil generally is not suited to building site development and onsite waste disposal because of the hazard of occasional flooding.

This soil is in capability subclass IVs and in woodland group 3s.

104—Udorthents-Urban land complex. This map unit consists of nearly level to moderately sloping, well drained to somewhat poorly drained soil and intermingled areas of Urban land. The soil has been cut or filled during the construction of Kansas City International Airport. The map unit is about 55 percent Udorthents, 40 percent Urban land, and 5 percent included soils. It is in one area of about 2,000 acres. Areas of Udorthents and Urban land form such an intricate pattern that it was not practical to map them separately.

Typically, Udorthents are about 60 percent cuts and 40 percent fills. The cuts range from a few inches to several feet in depth. Silty clay loam subsoil or underlying silt loam material is exposed at the surface. Fills range from a few inches to about 10 feet in depth. Generally, silty clay loam material is exposed at the surface of the fill.

Urban land is covered by airline terminals, landing strips, taxiways, parking aprons, streets, maintenance buildings, and other buildings that obscure the soils so that designation of a series is not feasible.

Included in mapping, and making up about 5 percent of the map unit, are small areas of somewhat poorly drained Higginsville soils and moderately well drained Sharpsburg soils. These soils are in areas that are relatively undisturbed, and a series can be identified. Higginsville soils are on side slopes, and Sharpsburg soils are on ridgetops.

Permeability is moderate or moderately slow in the Udorthents. Urban land is impervious to water. Surface runoff is medium to rapid and is removed through gutters and storm sewers. Natural fertility is medium in the Udorthents, and content of organic matter is low.

In most areas Udorthents are used for grass and landscape shrubbery. Because this map unit is so variable, a detailed onsite investigation is needed to determine the suitability for a proposed use.

This map unit was not assigned to a capability subclass or a woodland group.

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 providing the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not subject to frequent flooding during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table or are subject to flooding may qualify as prime farmland soils if the limitations or hazards are overcome by drainage or flood control. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

About 67,830 acres, or about 25 percent of the county, is prime farmland. An additional 35,075 acres meets the requirements for prime farmland only if the soil is drained or protected from flooding. More than 20,000 acres of the prime farmland soils are on ridgetops on uplands and have slopes of 2 to 5 percent. The rest is mainly in bottom land areas. Most of the prime farmland is presently used for cultivated crops.

A recent trend in land use, especially in the southern parts of the county, has been the conversion of some prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are wet, more erodible, droughty, or difficult to cultivate and less productive than prime farmland.

The map units, or soils, that make up prime farmland in Platte County are listed in table 5. On some soils included in the list, appropriate measures have been applied to overcome a hazard or limitation, such as flooding or wetness. In Platte County, the naturally wet soils generally have been adequately drained through the application of drainage measures. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

William M. Knight, District Conservationist, Soil Conservation Service, assisted in the preparation of 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.

Approximately 198,000 acres, or 72 percent of the county, was used for crops and pasture in 1980 according to Missouri Farm Facts. Of this total, about 50,000 acres were used for permanent pasture; 130,000 acres for cultivated crops, mainly corn, soybeans, sorghum and wheat; 18,000 acres for rotation hay and pasture. The remaining 75,000 acres were in woodland, urban and built-up areas, or in small tracts of 5 to 20 acres.

Because of livestock market fluctuations in the 1970's, the acreage used for row crops has increased, and the acreage in permanent pasture has shown a corresponding decrease.

The potential of the soils in Platte County for sustained production of food is good. More than 100,000 acres in the county is prime farmland. However, only about 35 percent of the cropland and pastureland in Platte County was adequately treated to meet conservation needs. Most of the cropland not adequately treated is in upland areas and is being farmed in a manner that causes erosion in excess of what is considered tolerable to sustain production over a long period of time. Some of the marginal cropland used for row crops should be converted to pasture and hayland. Soil erosion on most of the cropland can be held to a tolerable amount by using a system of conservation practices designed for specific sites. The most effective tool for predicting soil loss is the universal soil loss equation. This survey can greatly facilitate the application of such technology.

Loss of cropland due to highway construction and urban development has been moderate.

Soil erosion is the major problem on nearly all sloping cropland and overgrazed pastureland in Platte County. All soils that have slopes of more than 2 percent are susceptible to damage from erosion.

Loss of the surface layer through erosion is damaging for two reasons. 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 Armster soils or that have heavy silty clay loam subsoil, such as Ladoga and Sharpsburg soils. Erosion also reduces productivity of soils that tend to be droughty because they are shallow or moderately deep to bedrock, such as Basehor and Snead soils.

Soil erosion on farmland results in sediment entering streams, lakes, and ponds. Controlling erosion minimizes the pollution of streams by sediment and improves quality of water for municipal use, for recreation, and for fish and wildlife. Such control also prolongs the useful life of ponds and lakes by preventing them from filling up with sediment.

In many fields, seedbed preparation and tillage are difficult on clayey spots where the original friable surface soil has been eroded away. Armster, Ladoga, and Sharpsburg soils have such eroded spots.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover or residue on the soil can hold erosion losses to amounts that will not reduce the productive capacity of the soils. Grasses and legumes grown for pasture and hay effectively control erosion. Using legumes such as clover and alfalfa in the crop rotation improves tilth and provides nitrogen for the following crop.

Terraces reduce the length of slope and reduce runoff and erosion. Conventional terraces are most practical on uneroded upland soils that have long smooth slopes less than 8 percent. Special construction and management techniques are necessary for terrace systems to be effective on most strongly sloping areas of Armster, Ladoga, and Sharpsburg soils. Construction of grassed backslope terraces reduces the steepness of the slope. Construction of conventional terraces actually increases the slope and makes additional erosion control practices crucial. On these soils, cropping systems that provide substantial vegetative cover are needed to control erosion unless conservation tillage is practiced and large amounts of residue are utilized. Soil loss on moderately steep and steep Knox soils is severe if these soils are cultivated for row crops. Minimizing tillage on sloping soils and leaving large quantities of crop residue on the surface helps to increase infiltration and reduces the hazard of runoff and erosion. These practices can be adapted to many of the soils in the survey area but are more difficult to use successfully on eroded soils with clayey surface layers. On Armster, Ladoga, and Sharpsburg soils, special management techniques are generally required in areas where terracing has exposed the clayey subsoil.

If the soil is not suited to terraces or if an individual farmer prefers not to use terraces as a conservation practice, other practices effectively control erosion. Contour stripcropping reduces erosion by maintenance of contoured strips of permanent vegetation. These grass or grass-legume strips are generally used for hay. The areas between the strips are cultivated, and row crops are planted on the contour. "No-till" is becoming more common and effectively reduces erosion on sloping land. It can be used on many of the soils in Platte County. However, special management techniques are required in severely eroded areas.

Soil drainage and flood control are management concerns on all of the soils on flood plains. Occasional flooding can be a problem on the Bremer, Colo, Dockery, Kennebec, and Nodaway soils in the small stream bottoms. If flooding occurs, it is commonly during the period from November through May. Most areas in the small stream bottoms are so small it would be too costly to construct levees. Bremer and Colo soils are naturally so wet that crop production tends to be reduced, and surface drainage is generally needed on these soils.

Occasional flooding is a problem on the Haynie, Leta, Levasy, Parkville, and Waldron soils on the Missouri River flood plain. Flooding on these soils generally occurs in May and June. Levees protect the Missouri River bottoms; however, they are not high enough to protect the soil from major flooding. Leta, Levasy, Parkville, and Waldron soils are naturally wet and have a clayey surface soil. Land grading or surface drainage are needed in areas of these soils.

Soil fertility is naturally lower for most of the eroded soils and the shallow soils. However, all of the soils require additional plant nutrients for maximum production. Most of the soils in Platte County, except those on the Missouri River bottom lands, are naturally acid in the upper part of the rooting zone and require applications of ground limestone to raise the pH and calcium level sufficiently for optimum growth of legumes. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the production level desired. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in germination of seeds and infiltration of water into the soil. Soils that have good tilth are granular and porous. Most of the uneroded upland soils used for crops have a silt loam or silty clay loam surface layer that is dark in color and medium to high in content of organic matter. Generally, tillage and compaction cause the structure of the silt loam soils to become weaker, and intense rainfall results in the formation of a crust on the surface. The crust is hard when dry; it reduces water infiltration and increases runoff. Regularly adding crop residue, manure, and other organic material helps improve soil structure and tilth.

All of the eroded upland soils have more clay in the surface layer, poorer tilth, slower infiltration, and more rapid runoff than corresponding uneroded soils. These eroded soils need intensive conservation practices to prevent further erosion.

Fall plowing is common in Platte County. However, it is a poor practice on most of the upland soils. These soils are generally sloping and are subject to damaging erosion if they are plowed in the fall.

Bremer, Leta, Levasy, Parkville, and Waldron soils are clayey, and tilth tends to be poor because the soils commonly stay wet until late in spring. If they are plowed when wet, they tend to be cloddy when dry, and a seedbed is difficult to prepare. Fall plowing of these soils generally results in better tilth, and because the soils are nearly level, it does not result in damaging erosion.

Corn and soybeans are the field crops best suited to the soils and climate of the county and those most commonly grown. In 1980 they were grown on about 66,000 acres. Grain sorghum was grown on about 15,000 acres.

Wheat is the most common close growing crop and was grown on about 26,500 acres in 1980. Oats and rye can be grown, and grass seed can be produced from bromegrass, fescue, and orchardgrass.

Pasture and hay crops suited to the soils and climate include legumes, cool season grasses, and warm season native grasses. Alfalfa and red clover are the legumes commonly grown for hay. They are also used for hay and pasture in a mixture with bromegrass, orchardgrass, or fescue.

Warm season native grasses adapted to the soils in Platte County are big bluestem, little bluestem, indiangrass, and switchgrass. These grasses produce well during the hot summer months. They need different management techniques for establishment and grazing than cool season grasses.

Alfalfa is best suited to deep, moderately well drained or well drained soils such as Armster, Haynie, Kennebec, Knox, Ladoga, Nodaway, Sharpsburg, Sibley, and Wiota soils. The other legumes and all grasses do well on most of the upland soils. On Bremer, Colo, Dockery, Higginsville, Leta, Levasy, Parkville, and Waldron soils, moisture-tolerant plants should be selected.

The major management concern on most of the pastureland is overgrazing and gully erosion. Grazing should be controlled so that the plants survive and give maximum production. Keeping grasses at a desirable height reduces runoff and gully erosion.

Two types of irrigation, the center pivot and rain-gun systems, are currently being used in Platte County. Irrigation is used on the Missouri River bottom lands, where the water supply is plentiful (fig. 10). Irrigation increases yields and makes double-cropping a feasible alternative. Soybeans can be planted directly into wheat stubble. The irrigation system then supplies enough water to insure germination and crop growth. The large amount of residue on the surface helps protect the soil from erosion.

Small acreages of specialty crops, such as tobacco, apples, and Christmas trees, are grown in Platte County. These crops 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 yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures 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 grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*12*). Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

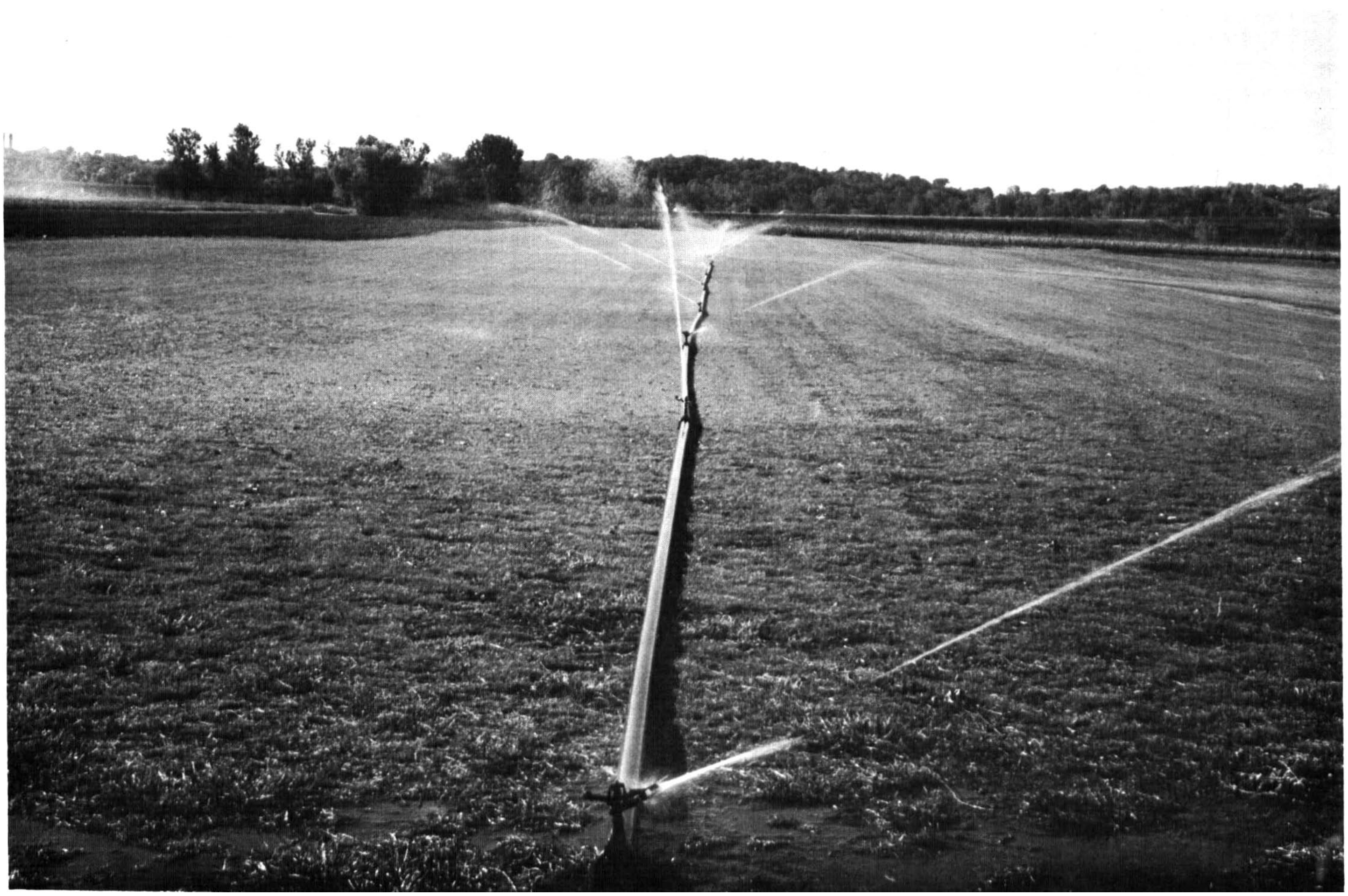

Figure 10.—Irrigation system in an area of Leta soils used for sod production.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

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

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

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

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

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

There are no class V or class VIII soils in Platte County.

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 limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6. The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Woodland Management and Productivity

James L. Robinson, forester, Soil Conservation Service, assisted in the preparation of this section.

Platte County has 32,600 acres of forest land which is approximately 12 percent of the total land area in the county, according to a 1972 Forest Service survey (*6*).

The majority of the woodland is in the Knox-Snead association and the Ladoga-Snead-Armster association. The Snead soil generally supports Northern red oak, black oak, white oak, white ash, elms, and hickories. Walnut also is a component. The Knox and Ladoga soils support the same species as the Snead soil; however, they generally have a higher percentage of white oak. These soils have very good potential for black walnut and other quality hardwoods.

The soils in the Nodaway-Colo-Wiota and Haynie-Parkville-Leta associations are on the major bottom lands. These soils are in woodland in frequently flooded areas, areas not protected by a levee, or areas where the drainage is inadequate for crops. Typical timber species are bottom land hardwoods, such as cottonwood, silver maple, green ash, sycamore, boxelder, pin oak, and black walnut. Nodaway, Kennebec, and Wiota soils are well suited to intensive black walnut management. Kennebec soils are of minor extent in the Nodaway-Colo-Wiota association.

The soils in the Sharpsburg-Higginsville-Sibley association formed under prairie vegetation; only the soils in the small drainage patterns and small bottoms were in trees. The bottom land areas that were too small and irregular to farm or were frequently flooded, remained in timber. With the exception of the Kennebec soils, which are of minor extent on the small bottoms, the soils in this association generally are not well suited to timber for wood crops.

Only a small acreage of the woodland in Platte County has received forest management in the past. Therefore, woodland improvement is needed to restore the woodland areas to their production potential.

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 important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

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

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

James L. Robinson, forester, Soil Conservation Service, assisted in the preparation of this section.

While windbreaks are needed throughout the county, farmsteads in the Ladoga-Snead-Armster and the Sharpsburg-Higginsville-Sibley associations are especially beneficial where protection from the cold winter winds and blowing snow is needed.

Field windbreaks are needed especially in those areas where intensive cropping is leaving very little crop residue on fields exposed to wind. Tobacco fields on the loess soils and cropland areas on the Haynie soil in the Haynie-Parkville-Leta association can develop wind erosion problems.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold 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 insure 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, the Missouri Department of Conservation, or the Cooperative Extension Service or from a nursery.

Recreation

Edward A. Gaskins, biologist, Soil Conservation Service, assisted in the preparation of this section.

The 1980 Statewide Comprehensive Outdoor Recreation Plan (SCORP) shows a total of 5,109 acres of existing recreational developments in Platte County (*9*). This acreage is 40 percent state owned, 11 percent municipal, 5 percent school owned, 28 percent private, and 16 percent belongs to the county and other owners. The facilities include lakes, river sports, swimming areas, hunting and fishing areas, campgrounds, trails, game courts, ballfields, picnic areas, play areas, a horse arena, and wildlife viewing areas. A 1976 SCORP report projected a minimum that the county needs to increase the miles of foot trails and bike paths, as well as the acres of playfields, fishing water, and hunting areas, by the target year of 1990. The total county population was projected to increase to 58,500 by that year (*7*).

The Platte Falls Wildlife Area, more than 1,900 acres, is the largest public recreational area in the county. This state-owned area offers fishing, hunting, and wildlife viewing to the general public. The Tiffany Springs Municipal Park, 477 acres, and the state-owned Daniel-Byer Wildlife Area, 151 acres, are the only other public areas larger than 100 acres. There are several smaller facilities, including access areas for fishing and small parks which are available to the general public.

When completed, the Smithville Lake recreation area will provide a tremendous increase in water-based recreation to the residents of northwestern Missouri. Nearly 6,000 acres will be devoted to recreational development. A structure located on the Little Platte River near Smithville will create a 7,190-acre lake having 175 miles of shoreline. The area is planned to accommodate 1,400,000 annual visitors and 11,500 people a day each weekend of the summer.

There will be six public parks connected with the reservoir. The parks will provide campsites, swimming beaches, boat marinas, a convention center, nature programs, a golf course, natural areas, visitor centers, picnic facilities, ballfields, and opportunities for a variety of water sports.

The 1974 NACD Nationwide Outdoor Recreation Inventory listed 23 private and semi-private commercial recreation enterprises in operation (*4*). These enterprises include swimming clubs, golf courses and riding stables to lake development properties, a gun club, campgrounds, and pay fishing lakes.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock 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

Edward A. Gaskins, biologist, Soil Conservation Service, assisted in the preparation of this section.

Platte County is one of 12 counties in Missouri that comprise the Northwest Prairie Zoogeographic Region. Prior to cultivation, 65 percent of this region was prairie, and 35 percent was woodland (*8*). Today, only a trace of the original "prairie" remains.

Kansas City is expanding, and the population of Platte County is predicted to increase 80.8 percent between 1970 and 1990 (*7*). This urban influence, including the conversion of woodland and grassland to cropland and homesites, is the most important factor affecting wildlife habitat.

The game species in Platte County are primarily those which favor an openland habitat in an agricultural area. Soybeans, corn, sorghum, and wheat are the four most important grain crops produced in the county. The Sharpsburg-Higginsville-Sibley, Nodaway-Colo-Wiota, and Haynie-Parkville-Leta soil associations provide the majority of the openland habitat for wildlife. However, the associations that are dominantly woodland also have large acreages of cropland and grassland. Small blocks of timber, waterways, hedgerows, fencerows, and other areas providing woody or brushy cover are scattered throughout these associations. Such "hard cover" areas supply an important type of habitat that is rapidly disappearing in many parts of the intensively agricultural areas.

The bobwhite quail is one of the most popular game species in the county and is heavily hunted. The quail population is rated good. The rabbit population is low. An abundant supply of food in close proximity to sufficient woody cover promotes an increase in quail and rabbit populations. The dove population is good and increases seasonally because of migratory flights. The county has a good population of pheasant which is increasing and expanding its range in the bottom land and along the Platte River drainageway.

In 1972, 32,600 acres in Platte County was classified as commercial forest land (*6*). The county presently has approximately 65,000 acres of wooded habitat, including noncommercial forest land. The Knox-Snead and Ladoga-Snead-Armster soil associations are dominantly wooded. The timbered parts of the other associations also provide habitat for woodland wildlife.

The county's deer population is rated good and is steadily increasing. Deer are heavily hunted by residents of the Kansas City area. Turkeys are scarce, and at present there is no hunting season for these game birds. Reports indicate that some turkeys have moved into the northern part of Platte County from a stocking at Bluff Woods in Buchanan County. The squirrel population, primarily fox squirrel, is good, and this game animal is not heavily hunted. Platte County has a small resident population of woodcock.

The furbearer population is good. The number of trappers has increased because of a continuing rise in fur values. The Bean Lake Area in the northwestern part of the county is one of the most popular areas for trapping. Harvest records show that raccoon, muskrat, coyote, opossum, beaver, and mink are the principal species trapped. Coyote hunting by organized groups is on the increase.

Nearly all of the remaining wetland is in the Haynie-Parkville-Leta soil association. Ninety percent of this total is in an area extending from Harpst Island to the Buchanan County line. There are no large waterfowl concentration areas during the fall migratory flight periods. Small populations of wood duck can be found on a few timbered streams that meet strict habitat requirements of these birds. Periodically, waterfowl from the Squaw Creek National Wildlife Refuge in Holt County and Smithville Lake in Clay County feed on cropfields in Platte County. Some of the county's lakes and ponds are used as resting sites during spring and fall migratory flights.

Fishing is available on rivers, streams, lakes, and farm ponds. Platte County has 93 miles of permanent flowing streams (*7*). These permanent streams and a few intermittent streams provide fishing to the local angler. The most important are the Missouri, Platte, and Little Platte Rivers and Sugar, Bear, Bee, Line, Castile, Shoal, and Brush Creeks. These waters contain channel catfish, black and yellow bullheads, paddlefish, bass, crappie, carp, buffalo, sturgeon, green sunfish, and bluegill. The Missouri River borders Platte County for approximately 50 miles. Commercial fishermen on the Missouri take carp, carpsucker, buffalo, catfish, and occasionally walleye, sauger, northern pike, paddlefish, crappie, and white bass. Sport fishermen generally fish the river for catfish, carp, and sturgeon, using jugs, trotlines, and limblines.

Several of the larger lakes in the county provide impoundment fishing. These lakes offer opportunities to fish for bass, bluegill, channel catfish, and crappie.

Approximately 1,300 farm ponds and small lakes in the county have been stocked with fish. Species include largemouth bass, channel catfish, and bluegill.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, millet, soybeans, and milo.

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 soil, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are bluegrass, switchgrass, orchardgrass, indiangrass, trefoil, clover, alfalfa, and crownvetch.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, pokeweed, foxtail, croton, and partridgepea.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, wild plum, sumac, persimmon, and sassafras. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are autumn-olive, crabapple, Amur honeysuckle, and hazelnut.

Coniferous plants furnish winter cover, 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 buttonbush.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, red fox, woodchuck, and mourning dove.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, and shrink-swell potential can cause the movement of footings. A high water table, depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials 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 the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock 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 contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, 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 type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by 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 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, 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 of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, 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 or to dense 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; and potential 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 or by toxic substances in the root zone, such as salts, sodium, or sulfur. 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. 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 reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind 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 wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

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. "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 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, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops.

They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

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 of 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 intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

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, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, 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 specified as 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 most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*13*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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 Fluvent (*Fluv*, meaning flood plain, plus *ent*, from Entisol).

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 Udifluvents (*Udi*, meaning humid, plus *fluvent*, the suborder of the Entisols that are on flood plains).

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

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

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

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*11*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*13*). 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."

Armster Series

The Armster series consists of deep, moderately well drained soils on uplands. Permeability is moderately slow. These soils formed in pedisediment and glacial till. Slopes range from 8 to 14 percent.

Armster soils are similar to Ladoga soils and commonly are adjacent to Ladoga, Sharpsburg, and Snead soils on the landscape. Ladoga and Sharpsburg soils do not have glacial sand. Sharpsburg soils have a mollic epipedon. They are on side slopes and ridgetops in higher positions than Armster soils. Snead soils are moderately deep and are on side slopes in lower positions than Armster soils.

Typical pedon in an area of Armster loam, 8 to 14 percent slopes, eroded, on the west section line, 1,050 feet north of the southwest corner of sec. 9, T. 54 N., R. 33 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; weak very fine granular structure; friable; many fine roots; few wormcasts; medium acid; abrupt smooth boundary.

BA—7 to 13 inches; dark brown (7.5YR 4/4) clay loam; weak very fine subangular blocky structure; friable; many fine roots; grayish brown (10YR 5/2) silt coatings on faces of peds; few wormcasts; slightly acid; clear smooth boundary.

2Bt1—13 to 19 inches; reddish brown (5YR 4/4) clay; moderate very fine subangular blocky structure; very firm; few fine roots; dark brown (7.5YR 4/4) coatings on faces of peds; many faint clay films; pebble line at a depth of 13 inches; slightly acid; clear smooth boundary.

2Bt2—19 to 25 inches; yellowish brown (10YR 5/4) clay; many fine prominent red (2.5YR 4/6) mottles; weak very fine subangular blocky structure; very firm; few fine roots; many faint clay films on faces of peds; black (10YR 2/1) stains; strongly acid; clear smooth boundary.

2Bt3—25 to 36 inches; yellowish brown (10YR 5/6) clay; few fine distinct grayish brown (10YR 5/2) and common fine distinct light brownish gray (10YR 6/2) mottles; weak very fine subangular blocky structure; very firm; few fine roots; many faint clay films on faces of peds; strongly acid; gradual smooth boundary.

2Bt4—36 to 50 inches; yellowish brown (10YR 5/6) clay; common fine distinct light brownish gray (10YR 6/2) and few fine distinct grayish brown (10YR 5/2) mottles; weak fine prismatic structure parting to moderate very fine subangular blocky; very firm; many faint dark brown (7.5YR 4/4) clay films on faces of peds; black (10YR 2/1) stains and concretions; grayish brown (10YR 5/2) silt coatings; strongly acid; clear smooth boundary.

BC—50 to 60 inches; yellowish brown (10YR 5/6) clay; few fine distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to moderate coarse subangular blocky; very firm; dark brown (7.5YR 4/4) clay films on vertical faces of peds; many black (10YR 2/1) stains on faces of peds; neutral.

The solum ranges from 46 to more than 60 inches in thickness. A weak pebble line is commonly along the top of the 2Bt1 horizon. Reaction ranges from very strongly acid to neutral.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. It is typically loam, although it is clay loam in eroded areas. The BA horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 5. It is loam or clay loam. The 2Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 to 6, and chroma of 4 or 6. In the upper part of the argillic horizon either the matrix or mottles have hue of 5YR or redder. The 2Bt horizon is clay loam or clay. The BC horizon has hue of 5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 8. It is clay loam or clay.

Basehor Series

The Basehor series consists of shallow, well drained soils on uplands. Permeability is moderately rapid. These soils formed in loamy residuum of fine grained sandstone. Slopes range from 5 to 14 percent.

Basehor soils are adjacent to Higginsville, Sharpsburg, and Snead soils on the landscape. Higginsville and Sharpsburg soils are deep and are on ridgetops and side slopes in higher positions than Basehor soils. Snead soils are moderately deep and are on side slopes in lower positions than Basehor soils.

Typical pedon in an area of Basehor loam, 5 to 14 percent slopes, 2,340 feet south and 690 feet west of the northeast corner of sec. 30, T. 52 N., R. 34 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; very friable; many fine and medium roots; slightly acid; clear smooth boundary.

BA—4 to 7 inches; brown (10YR 4/3) loam; weak fine granular structure; very friable; many fine and medium roots; small partly weathered sandstone fragments about 15 percent by volume; medium acid; clear smooth boundary.

Bw—7 to 13 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine subangular blocky structure; very friable; common fine and medium roots; small weathered sandstone fragments about 15 percent by volume; strongly acid; abrupt smooth boundary.

Cr—13 to 15 inches; strong brown (7.5YR 4/6) rippable sandstone.

R—15 inches; hard sandstone.

The thickness of the solum and depth to sandstone bedrock range from 11 to 20 inches. Reaction is medium acid or strongly acid except for some pedons in which the A horizon is slightly acid.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. It is typically loam, although in a few places it is fine sandy loam. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is loam or fine sandy loam.

Bremer Series

The Bremer series consists of deep, poorly drained soils on terraces along tributaries of the Missouri River. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Bremer soils are similar to Colo soils and commonly are adjacent to Colo, Dockery, Nodaway, and Wiota soils on the landscape. Colo soils do not have an argillic horizon. Dockery and Nodaway soils do not have an argillic horizon and are in lower positions on the flood plain, adjacent to streams. Wiota soils are well drained and are on terraces, in higher positions than Bremer soils.

Typical pedon in an area of Bremer silt loam, 450 feet west and 1,650 feet south of the northeast corner of sec. 26, T. 53 N., R. 35 W.

A1—0 to 9 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; many fine roots and pores; neutral; clear smooth boundary.

A2—9 to 17 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; many fine roots and pores; neutral; clear smooth boundary.

BA—17 to 24 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; firm; many fine roots and pores; slightly acid; clear smooth boundary.

Bt1—24 to 34 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; few fine prominent dark brown (7.5YR 3/4) mottles; moderate fine angular blocky structure; firm; many fine roots and pores; thin continuous clay films; slightly acid; clear smooth boundary.

Bt2—34 to 44 inches; dark gray (10YR 4/1) silty clay loam; few fine prominent dark brown (7.5YR 3/4) mottles; weak fine subangular blocky structure; firm; few fine roots and pores; few faint clay films; slightly acid; gradual smooth boundary.

BC—44 to 59 inches; dark gray (10YR 4/1) silty clay loam; common fine faint gray (10YR 5/1) and dark grayish brown (10YR 4/2) and few fine distinct dark yellowish brown (10YR 4/6) mottles; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium subangular blocky structure; friable; few fine roots and pores; black (10YR 2/1) coatings in old root channels; slightly acid; clear smooth boundary.

C—59 to 64 inches; mottled gray (10YR 5/1) and dark grayish brown (10YR 4/2) silty clay loam; few fine distinct dark yellowish brown (10YR 4/6) mottles; massive; friable; black (10YR 2/1) coatings in old root channels; soft iron and manganese accumulations; slightly acid.

The solum is 40 to 60 inches thick. It is medium acid or slightly acid.

The A horizon is black (10YR 2/1) or very dark gray (N 3/0). The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 2 to 4, and chroma of 1. Mottles have chroma as high as 6. Colors that have value of 2 or 3 and chroma of 1 extend to a depth of 24 to 36 inches. The B horizon is silty clay loam or silty clay. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It has mottles of higher chroma.

Colo Series

The Colo series consists of deep, poorly drained soils on bottom lands. Permeability is moderate. These soils formed in thick deposits of silty alluvium. Slopes range from 0 to 2 percent.

Colo soils are similar to Bremer soils and commonly are adjacent to Bremer, Dockery, Nodaway, and Wiota soils on the landscape. Bremer and Wiota soils have an argillic horizon and are on terraces in higher positions than Colo soils. Dockery and Nodaway soils are stratified and are nearer to the stream channel than Colo soils.

Typical pedon in an area of Colo silt loam, 980 feet north and 1,100 feet east of the southwest corner of sec. 13, T. 53 N., R. 34 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; friable; few fine roots; slightly acid; abrupt smooth boundary.

A1—6 to 30 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine oxide accumulations; slightly acid; gradual smooth boundary.

A2—30 to 45 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; few fine distinct grayish brown (10YR 5/2) and dark yellowish brown (10YR 3/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; medium acid; gradual smooth boundary.

AC—45 to 60 inches; very dark gray (10YR 3/1) silty clay loam; common fine distinct grayish brown (10YR 5/2) and few fine distinct dark yellowish brown (10YR 3/6) mottles; weak fine subangular blocky structure; firm; few fine roots; medium acid.

The solum is 36 to 54 inches thick. The mollic epipedon is 36 or more inches thick.

The Ap horizon is very dark grayish brown (10YR 3/2) silt loam. In some areas it is black (10YR 2/1) silty clay loam. The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 2 or 3, and chroma of 0 or 1. Mottles that have higher value and chroma are at a depth of 24 inches or more. The A horizon is silty clay loam that is 30 to 35 percent clay. The AC horizon is similar in color and texture to the

A horizon. The C horizon, where present, has colors that have higher value than those of the A horizon.

Dockery Series

The Dockery series consists of deep, somewhat poorly drained soils on major tributaries of the Missouri River. Permeability is moderately slow. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Dockery soils commonly are adjacent to Bremer, Colo, Nodaway, and Wiota soils on the landscape. Bremer and Wiota soils have an argillic horizon and are on terraces. Colo soils do not have the prominent stratification of the Dockery soils and are farther from the stream channel. Nodaway soils are moderately well drained and are closer to the stream channel than Dockery soils.

Typical pedon in an area of Dockery silt loam, 900 feet west and 1,950 feet south of the northeast corner of sec. 24, T. 54 N., R. 34 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; friable; few fine roots; slightly acid; abrupt smooth boundary.

C1—8 to 15 inches; stratified very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), and grayish brown (10YR 5/2) silt loam; massive; friable; few fine roots; slightly acid; gradual smooth boundary.

C2—15 to 24 inches; stratified very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), and grayish brown (10YR 5/2) silt loam; few fine distinct dark yellowish brown (10YR 4/6) stains on horizontal bedding planes and root pores; massive; friable; few fine roots; neutral; clear smooth boundary.

C3—24 to 30 inches; stratified dark gray (10YR 4/1), very dark gray (10YR 3/1), and grayish brown (10YR 5/2) silt loam; few coarse prominent dark reddish brown (2.5YR 2.5/4) stains on horizontal bedding planes and root pores; massive; friable; few fine roots; neutral; clear smooth boundary.

C4—30 to 64 inches; stratified dark gray (10YR 4/1) and very dark gray (5Y 3/1) silt loam; massive; friable; few fine roots; slightly acid.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is dominantly silt loam, although the range includes silty clay loam. The C horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3. Mottles have value of 4 to 6 and chroma of 2 to 8. The C horizon is dominantly silt loam, although the range includes silty clay loam. It is stratified throughout.

Haynie Series

The Haynie series consists of deep, moderately well drained soils on bottom lands of the Missouri River. Permeability is moderate. These soils formed in loamy and silty alluvium. Slopes range from 0 to 2 percent.

Haynie soils are similar to Nodaway soils and commonly are adjacent to Leta, Levasy, and Parkville soils on the landscape. Nodaway soils are not calcareous and are on the smaller stream bottoms. Leta, Levasy, and Parkville soils are clayey in the upper part and loamy in the lower part. They are in slightly lower positions on the landscape than Haynie soils.

Typical pedon in an area of Haynie silt loam, clayey substratum, 1,980 feet west and 25 feet north of the southeast corner of sec. 3, T. 54 N., R. 37 W.

Ap—0 to 9 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 fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—9 to 19 inches; grayish brown (10YR 5/2) very fine sandy loam; light brownish gray (10YR 6/2) uncoated sand grains; massive; very friable; few fine roots; strong effervescence; mildly alkaline; abrupt smooth boundary.

C2—19 to 41 inches; brown (10YR 5/3) very fine sandy loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; few fine roots; 4-inch layer of brown (10YR 4/3) silt loam; strong effervescence; mildly alkaline; clear smooth boundary.

C3—41 to 54 inches; stratified grayish brown (10YR 5/2) and brown (10YR 5/3) very fine sandy loam; thin strata of dark grayish brown (10YR 4/2) silty clay loam that has common fine prominent dark reddish brown (2.5YR 3/4) mottles; massive; very friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

Ab—54 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine prominent dark reddish brown (2.5YR 3/4) mottles; moderate medium granular structure; firm; mildly alkaline.

The solum is less than 10 inches thick. Depth to free carbonates ranges from 0 to 10 inches.

The A horizon has hue of 10YR or 2.5Y, value of 3, and chroma of 2. It is typically silt loam, although in some places it is very fine sandy loam or silty clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. Mottles have value of 3 to 5 and chroma of 4 to 8. Silty clay loam or silty clay is below a depth of 50 inches.

Haynie Variant

The Haynie Variant consists of deep, somewhat poorly drained soils on flood plains of the Missouri River. Permeability is moderate. These soils formed in loamy and silty alluvium. Slopes range from 0 to 2 percent.

Haynie Variant soils are similar to Haynie soils and commonly are adjacent to Haynie, Leta, and Parkville soils on the landscape. Haynie soils have a dark surface layer and do not have mottles that have chroma of 2 above a depth of 20 inches. Leta and Parkville soils are clayey in the upper part and loamy in the lower part. They are in slightly lower positions on the landscape than the Haynie Variant soils.

Typical pedon in an area of Haynie Variant silt loam, 2,100 feet north and 500 feet west of the southeast corner of sec. 11, T. 54 N., R. 37 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; weak very fine granular structure; very friable; many fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—6 to 11 inches; dark grayish brown (10YR 4/2) silt loam; appears massive but has distinct bedding planes; very friable; many fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

C2—11 to 29 inches; dark grayish brown (10YR 4/2) silt loam; thin layers of very fine sand; few medium faint grayish brown (10YR 5/2) mottles; massive; very friable; many fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

C3—29 to 60 inches; grayish brown (10YR 5/2) silt loam; thin layers of very fine sand; few medium faint very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) mottles; massive; very friable; common fine roots; strong effervescence; mildly alkaline.

The solum is less than 10 inches thick. Depth to free carbonates ranges from 0 to 10 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4, and chroma of 2. It is typically silt loam, although the range includes very fine sandy loam. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2. Mottles have value of 4 to 6 and chroma of 2 to 6. The C horizon has thin lenses and layers of finer and coarser material.

Higginsville Series

The Higginsville series consists of deep, somewhat poorly drained soils on uplands. Permeability is moderate. These soils formed in thick deposits of loess. Slopes range from 5 to 9 percent.

Higginsville soils commonly are adjacent to Kennebec, Sharpsburg, and Sibley soils on the landscape. Kennebec soils do not have an argillic horizon and are on narrow flood plains. Sharpsburg soils are moderately well drained, and Sibley soils are well drained. Sharpsburg and Sibley soils are on ridgetops, in higher positions than Higginsville soils.

Typical pedon in an area of Higginsville silt loam, 5 to 9 percent slopes, eroded, 1,600 feet west and 15 feet north of the southeast corner of sec. 17, T. 52 N., R. 34 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; few fine roots; slightly acid; abrupt smooth boundary.

Bt1—8 to 13 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; friable; few fine roots; few medium pores; thin continuous clay films; slightly acid; clear smooth boundary.

Bt2—13 to 19 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine distinct light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; friable; few fine roots; few medium pores; very dark grayish brown (10YR 3/2) coatings on faces of peds; few small concretions (iron and manganese oxides); thin continuous clay films; slightly acid; clear smooth boundary.

Bt3—19 to 27 inches; grayish brown (10YR 5/2) silty clay loam; few fine faint dark grayish brown (10YR 4/2) mottles; moderate fine subangular blocky structure; friable; few fine roots; few small concretions (iron and manganese oxides); many faint clay films; slightly acid; gradual smooth boundary.

Bt4—27 to 42 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent yellowish red (5YR 4/6) mottles; weak coarse subangular blocky structure; friable; many faint clay films; slightly acid; clear smooth boundary.

C1—42 to 52 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine prominent yellowish red (5YR 4/6) mottles; massive; friable; slightly acid; abrupt smooth boundary.

C2—52 to 60 inches; mixed light brownish gray (10YR 6/2) and brown (10YR 5/3) silty clay loam; many fine prominent yellowish red (5YR 4/6) mottles; massive; friable; slightly acid.

The solum is 38 to 54 inches thick. The mollic epipedon is 10 to 24 inches thick. Reaction ranges from medium acid to neutral.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is typically silt loam, although the range includes silty clay loam. The Bt horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 or 3. In the lower part, the range in value includes 5. In some pedons, the coating on the faces of peds has chroma of 1. Mottles that have higher value and chroma are commonly present. The clay content ranges from 32 to 35 percent. The C horizon has hue of 10YR through 5Y, value of 4 to 6, and chroma of 1 to 3. Mottles have hue of 5YR, 7.5YR, or 10YR, value of 3 to 5, and chroma of 3 to 8.

Kennebec Series

The Kennebec series consists of deep, moderately well drained soils on small stream bottoms. Permeability is moderate. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Kennebec soils commonly are adjacent to Higginsville, Knox, and Snead soils on the landscape. Higginsville and Knox soils have an argillic horizon, and Snead soils are moderately deep. These soils are on upland side slopes, in higher positions than Kennebec soils.

Typical pedon in an area of Kennebec silt loam, 2,780 feet south and 750 feet east of the northwest corner of sec. 9, T. 54 N., R. 33 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; friable; common fine roots; neutral; abrupt smooth boundary.

A1—6 to 13 inches; very dark gray (10YR 3/1) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common fine roots; slightly acid; clear smooth boundary.

A2—13 to 35 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; few fine roots; slightly acid; clear smooth boundary.

AC—35 to 60 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; few fine roots; slightly acid.

The solum and the mollic epipedon are more than 36 inches thick. Reaction ranges from medium acid to neutral.

The Ap horizon has hue of 10YR, value of 3, and chroma of 2. It is silt loam. In some pedons the Ap horizon has chroma of 1. The A horizons below the Ap horizon have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. In some pedons the value increases with depth. The clay content in the control section is 24 to 30 percent.

Knox Series

The Knox series consists of deep, well drained soils on uplands. Permeability is moderate. These soils formed in thick deposits of loess. The slope ranges from 5 to 30 percent.

Knox soils are similar to Ladoga soils and commonly are adjacent to Kennebec, Sibley, and Snead soils on the landscape. Kennebec soils do not have an argillic horizon and are on narrow flood plains. Ladoga soils have a finer textured argillic horizon than the Knox soils. Sibley soils have a mollic epipedon and are on broad ridgetops. Snead soils have a mollic epipedon, are moderately deep, and are on side slopes in lower positions than Knox soils.

Typical pedon in an area of Knox silt loam, 5 to 9 percent slopes, eroded, 2,000 feet south and 400 feet east of the center of sec. 23, T. 52 N., R. 35 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; brown (10YR 4/3) material mixed in the lower part; moderate fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

Bt1—8 to 20 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; friable; few fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—20 to 29 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; many faint dark yellowish brown (10YR 3/4) clay films on faces of peds; medium acid; gradual smooth boundary.

Bt3—29 to 37 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium subangular blocky structure; friable; few fine roots; many faint dark yellowish brown (10YR 3/4) clay films on faces of peds; medium acid; clear smooth boundary.

Bt4—37 to 47 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine faint brown (10YR 5/3) mottles; weak coarse subangular blocky structure; friable; few fine roots; common faint dark yellowish brown (10YR 3/4) clay films on vertical cleavage; medium acid; clear smooth boundary.

C—47 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; few fine faint brown (10YR 5/3) mottles; massive; friable; medium acid.

The solum is 36 to more than 60 inches thick.

The A, or Ap, horizon has hue of 10YR, value of 3, and chroma of 2 or 3. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam. The B horizon typically is slightly acid, although it ranges from medium acid to neutral. The C horizon is similar in color to the B horizon and is silt loam.

Knox silty clay loam, 9 to 14 percent slopes, severely eroded, and Knox silty clay loam, 14 to 20 percent slopes, severely eroded, and the Knox soil in the Knox-Urban land complex, 9 to 14 percent slopes, have a dark surface layer that is thinner than is definitive for the Knox series. However, this difference does not significantly affect the use and management of the soils.

Ladoga Series

The Ladoga series consists of deep, moderately well drained soils on uplands. Permeability is moderately slow. These soils formed in thick deposits of loess. Slopes range from 2 to 14 percent.

Ladoga soils are similar to Knox and Sharpsburg soils and commonly are adjacent to Armster, Sharpsburg, and Snead soils on the landscape. Armster soils have more sand and gravel. Snead soils are moderately deep. Armster and Snead soils are on side slopes, in lower positions than Ladoga soils. Knox soils have less clay in the argillic horizon than Ladoga soils, and Sharpsburg soils have a mollic epipedon.

Typical pedon in an area of Ladoga silt loam, 2 to 5 percent slopes, 200 feet west and 375 feet south of the northeast corner of sec. 26, T. 54 N., R. 34 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; weak very fine granular structure; friable; many fine roots; few wormcasts; slightly acid; abrupt smooth boundary.

E—6 to 9 inches; mixed dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam; weak very fine granular structure; friable; many fine roots; few wormcasts; some grayish brown (10YR 5/2) silt coatings; slightly acid; clear smooth boundary.

Bt1—9 to 14 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate very fine subangular blocky structure; firm; few fine roots; few wormcasts; many faint brown (10YR 4/3) clay films; medium acid; clear smooth boundary.

Bt2—14 to 22 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; few wormcasts; many faint brown (10YR 4/3) clay films; medium acid; clear smooth boundary.

Bt3—22 to 30 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine distinct brown (10YR 5/3) and few fine distinct dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; many faint brown (10YR 4/3) clay films; strongly acid; clear smooth boundary.

Bt4—30 to 40 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine distinct brown (10YR 5/3) and few fine distinct dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; few fine roots; many faint brown (10YR 4/3) clay films; strongly acid; gradual smooth boundary.

C—40 to 60 inches; brown (10YR 5/3) silty clay loam; common fine faint dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) mottles; massive; friable; few fine roots; common faint brown (10YR 4/3) clay films along vertical cleavage; strongly acid.

The solum is 36 to 72 inches thick. It is medium acid to strongly acid in the most acid part.

The A, or Ap, horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon typically has hue of 10YR, value of 4 or 5, and chroma of 2. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Mottles that have chroma of 2 are in the lower part. The Bt horizon is 36 to 42 percent clay. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Mottles have lower chroma.

Ladoga silt loam, 5 to 9 percent slopes, eroded, has a thinner dark colored surface layer than is definitive for the series. However, this difference does not significantly affect the use and management of the soils.

Leta Series

The Leta series consists of deep, somewhat poorly drained soils on flood plains of the Missouri River. These soils are slowly permeable in the upper part and moderately permeable in the lower part. They formed in clayey alluvium over loamy alluvium. Slopes range from 0 to 2 percent.

Leta soils are similar to Parkville soils and commonly are adjacent to Haynie, Levasy, Parkville, and Waldron soils on the landscape. Haynie soils are coarse-silty and are in slightly higher positions than Leta soils. Levasy soils are poorly drained and are in slightly lower positions. Parkville soils are shallower to loamy material than Leta soils. Waldron soils do not have underlying loamy material and are in slightly lower positions than Leta soils.

Typical pedon in an area of Leta silty clay, 2,250 feet south of the center of sec. 4, T. 53 N., R. 36 W.

Ap—0 to 3 inches; black (10YR 2/1) silty clay, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; firm; few fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

A—3 to 11 inches; very dark brown (10YR 2/2) silty clay, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; firm; few fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

Bw—11 to 24 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint brown (10YR 4/3) and few fine distinct dark yellowish brown (10YR 4/4) mottles; weak very fine subangular blocky structure; firm; few fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

2C—24 to 60 inches; grayish brown (10YR 5/2) very fine sandy loam; few medium prominent dark yellowish brown (10YR 4/6) mottles; massive appearance, weak bedding planes; strong effervescence; mildly alkaline.

The solum is 20 to 38 inches thick. Free carbonates are typically throughout the profile. The mollic epipedon is 10 to 20 inches thick.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. It is typically silty clay, although the range includes silty clay loam. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or

2. It is silty clay or silty clay loam. The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. Mottles have higher chroma. The 2C horizon is silt loam and very fine sandy loam.

Levasy Series

The Levasy series consists of deep, poorly drained soils on flood plains of the Missouri River. These soils are slowly permeable in the upper part and moderately permeable in the lower part. They formed in clayey alluvium over loamy alluvium. Slopes range from 0 to 2 percent.

Levasy soils commonly are adjacent to Haynie, Leta, Parkville, and Waldron soils on the landscape. Haynie soils are coarse-silty and are in higher positions than Levasy soils. Leta and Waldron soils are somewhat poorly drained and are in slightly higher positions. Parkville soils are shallower to loamy material than Levasy soils and are in slightly higher positions.

Typical pedon in an area of Levasy silty clay, 2,310 feet north and 25 feet east of the southwest corner of sec. 36, T. 75 N., R. 22 E.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to moderate fine granular; firm; few fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

A1—6 to 17 inches; very dark grayish brown (2.5Y 3/2) silty clay, dark grayish brown (2.5Y 4/2) dry; few fine prominent reddish brown (5YR 4/4) mottles; moderate fine subangular blocky structure; firm; few fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

A2—17 to 29 inches; dark grayish brown (2.5Y 4/2) silty clay; few fine prominent reddish brown (5YR 4/4) mottles; weak fine subangular blocky structure; firm; few fine roots; dark gray (10YR 4/1) coatings on faces of peds; strong effervescence; mildly alkaline; abrupt smooth boundary.

2C—29 to 60 inches; stratified grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) very fine sandy loam; common fine distinct gray (10YR 5/1) and yellowish brown (10YR 4/4) mottles and few fine prominent reddish brown (5YR 4/4) mottles; massive; very friable; 2-inch layer of very dark gray (10YR 3/1) silty clay; few fine roots; violent effervescence; mildly alkaline.

The mollic epipedon is 10 to 24 inches thick. The clayey A horizon is underlain at a depth of 20 to 38 inches by loamy deposits. Free carbonates are throughout. Reaction is mildly or moderately alkaline.

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, 2.5Y, or 5Y, value of 2 to 4, and chroma of 1 or 2. The Ap horizon is typically silty clay loam, although the range includes silty clay and clay. The 2C horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 or 2. It is fine sandy loam, loam, very fine sandy loam, or silt loam. The A and 2C horizons have mottles that have value of 5 or lower and chroma of 8 or lower.

Nodaway Series

The Nodaway series consists of deep, moderately well drained soils on bottom lands. Permeability is moderate. These soils formed in stratified silty alluvium. Slopes range from 0 to 2 percent.

Nodaway soils are similar to Haynie soils and commonly are adjacent to Bremer, Colo, Dockery, and Wiota soils on the landscape. Bremer and Wiota soils have an argillic horizon and are on terraces, in higher positions than Nodaway soils. Colo soils have more clay and have a thick mollic epipedon. They are in positions between Nodaway soils and the uplands. Dockery soils are somewhat poorly drained and are in slightly lower positions than Nodaway soils. Haynie soils are calcareous and are on flood plains of the Missouri River.

Typical pedon in an area of Nodaway silt loam, 2,210 feet east and 690 feet north of the southwest corner of sec. 16, T. 53 N., R. 34 W.

A—0 to 6 inches; stratified thin layers of very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; very thin layers of dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2); weak platy structure parting to weak fine granular; friable; many fine roots; slightly acid; abrupt smooth boundary.

C—6 to 60 inches; stratified dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), black (10YR 2/1), very dark gray (10YR 3/1), and very dark grayish brown (10YR 3/2) silt loam, a few thin layers of silty clay loam; massive within strata; friable; common fine roots; slightly acid.

The solum is 6 to 10 inches thick. Reaction is slightly acid to neutral.

The A horizon has hue of 10YR, value of 3, and chroma of 1 or 2. The C horizon has hue of 10YR, value of 2 to 5, and chroma of 1 to 3. It is stratified silt loam and has thin lenses of coarser or finer material.

Parkville Series

The Parkville series consists of deep, somewhat poorly drained soils on flood plains of the Missouri River. Permeability is slow in the upper part and moderate in the lower part. These soils formed in clayey alluvium over loamy material. Slopes range from 0 to 2 percent.

Parkville soils are similar to Leta soils and commonly are adjacent to Haynie, Leta, Levasy, and Waldron soils on the landscape. Haynie soils are coarse silty. Leta and

Levasy soils have clayey horizons to a depth of more than 20 inches and are on flood plains, in slightly lower positions than Parkville soils. Waldron soils are clayey throughout and are also in slightly lower positions on the flood plains.

Typical pedon in an area of Parkville silty clay loam, 950 feet south and 125 feet east of the northwest corner of sec. 12, T. 52 N., R. 36 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; strong fine granular structure in the upper part and strong very fine subangular blocky in the lower part; firm, sticky and plastic; common fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

AB—8 to 16 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium angular blocky structure; firm, sticky and plastic; common fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

2C1—16 to 32 inches; dark grayish brown (10YR 4/2) very fine sandy loam; few fine faint brown (10YR 4/3) mottles; appears massive but has distinct bedding planes; friable, nonsticky and nonplastic; common fine roots; dark gray (10YR 4/1) silt loam discontinuous lens, as much as 2 inches thick, at the bottom of the horizon; slight effervescence; mildly alkaline; abrupt smooth boundary.

2C2—32 to 45 inches; dark grayish brown (10YR 4/2) silt loam; massive; friable, nonsticky and nonplastic; few fine roots; dark gray (10YR 4/1) silt loam lens, as much as 1/2-inch thick, at the bottom of the horizon; slight effervescence; mildly alkaline; abrupt smooth boundary.

2C3—45 to 60 inches; stratified dark grayish brown (10YR 4/2) very fine sandy loam and silt loam; massive; friable, nonsticky and nonplastic; slight effervescence; mildly alkaline.

The solum is 12 to 20 inches thick. Free carbonates typically are throughout the profile. The mollic epipedon averages between 10 and 20 inches thick.

The Ap horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 to 3. It is typically silty clay loam, although the range includes silty clay. The Ap horizon is neutral to moderately alkaline. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 or 3. It is silt loam or very fine sandy loam and ranges from mildly alkaline to moderately alkaline.

Sarpy Series

The Sarpy series consists of deep, excessively drained soils on bottom lands. Permeability is rapid. These soils formed in sandy alluvium. Slopes range from 0 to 2 percent.

Sarpy soils commonly are adjacent to Haynie, Leta, and Parkville soils on the landscape. Haynie soils are coarse silty and are in lower positions on the flood plains. Leta and Parkville soils are clayey over loamy and are also in lower positions on the flood plains.

Typical pedon in an area of Sarpy fine sandy loam, 960 feet north and 910 feet west of the southeast corner of sec. 11, T. 54 N., R. 37 W.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; grayish brown (10YR 5/2) uncoated sand grains; weak very fine granular structure; very friable; many fine roots; mildly alkaline; clear smooth boundary.

A2—3 to 6 inches; very dark grayish brown (10YR 3/2) fine sand, grayish brown (10YR 5/2) dry; grayish brown (10YR 5/2) uncoated sand grains; single grained; very friable; many fine roots; mildly alkaline; clear smooth boundary.

C1—6 to 47 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; common fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

C2—47 to 51 inches; dark grayish brown (10YR 4/2) loamy fine sand; grayish brown (10YR 5/2) uncoated sand grains; massive; very friable; few fine roots; strong effervescence; moderately alkaline; abrupt smooth boundary.

C3—51 to 60 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; few fine roots; strong effervescence; moderately alkaline.

The soil is neutral to moderately alkaline. In most pedons free carbonates are throughout the control section.

The A, or Ap, horizon has hue of 10YR, value of 3 to 5, and chroma of 1 to 3. It is typically fine sandy loam, although the range includes sand, loamy sand, loamy fine sand, and fine sand.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is loamy fine sand, loamy sand, fine sand, or sand. The C horizon is stratified throughout.

Sharpsburg Series

The Sharpsburg series consists of deep, moderately well drained soils on uplands. Permeability is moderately slow. These soils formed in thick deposits of loess. The slope ranges from 2 to 14 percent.

Sharpsburg soils are similar to Ladoga and Sibley soils and commonly are adjacent to Higginsville and Sibley soils on the landscape. Higginsville soils are somewhat poorly drained and are on side slopes, in lower positions than Sharpsburg soils. Ladoga soils do not have a mollic epipedon. Sibley soils are well drained and have a thicker mollic epipedon than Sharpsburg soils.

Typical pedon in an area of Sharpsburg silt loam, 2 to 5 percent slopes, 1,070 feet south and 100 feet west of the northeast corner of sec. 21, T. 52 N., R. 33 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; many fine roots; slightly acid; clear smooth boundary.

A—8 to 13 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure parting to moderate medium granular; friable; many fine roots; slightly acid; clear smooth boundary.

BA—13 to 19 inches; mixed dark brown (10YR 3/3) and dark yellowish brown (10YR 3/4) silty clay loam; moderate fine subangular blocky structure; friable; many fine roots; medium acid; clear smooth boundary.

Bt1—19 to 26 inches; dark brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; firm; many fine roots; many faint dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—26 to 35 inches; dark brown (10YR 4/3) silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; many faint dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; gradual smooth boundary.

Bt3—35 to 43 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and few fine prominent strong brown (7.5YR 4/6) mottles; weak medium subangular blocky structure; firm; common fine roots; many faint clay films on faces of peds; few black iron-manganese stains; medium acid; gradual smooth boundary.

Bt4—43 to 55 inches; mottled dark yellowish brown (10YR 4/4), grayish brown (10YR 5/2), and strong brown (7.5YR 4/6) silty clay loam; weak coarse subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; few fine roots; common black iron-manganese stains; medium acid; clear smooth boundary.

C—55 to 60 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) silty clay loam; massive; friable; few fine roots; common black iron-manganese stains; slightly acid.

The solum is 40 to 60 inches thick. The mollic epipedon is 10 to 20 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It typically is silt loam, although the range includes silty clay loam. The B horizon has hue of 10YR, value of 4, and chroma of 3 or 4. In the lower part it has mottles that have hue of 10YR, value of 4 or 5, and chroma of 2 through 8. The Bt horizon is 36 to 42 percent clay. The C horizon is silty clay loam or silt loam.

Sibley Series

The Sibley series consists of deep, well drained soils on uplands. Permeability is moderate. These soils formed in thick deposits of silty loess. Slopes range from 2 to 9 percent.

Sibley soils are similar to Sharpsburg and Wiota soils and commonly are adjacent to Higginsville, Knox, and Sharpsburg soils on the landscape. Higginsville soils are somewhat poorly drained and are on side slopes, in lower positions than Sibley soils. Knox soils do not have a mollic epipedon and are on narrow ridgetops and on side slopes. Sharpsburg soils have a mollic epipedon less than 20 inches thick and have more clay than Sibley soils. Wiota soils are on low terraces and have more fine and coarse sand.

Typical pedon in an area of Sibley silt loam, 2 to 5 percent slopes, about 2,400 feet south and 1,000 feet east of the northwest corner of sec. 31, T. 52 N., R. 34 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; friable; few fine roots; medium acid; abrupt smooth boundary.

AB—6 to 16 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to moderate very fine granular; friable; few fine roots; medium acid; clear smooth boundary.

Bt1—16 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; few fine roots; many faint clay films; medium acid; clear smooth boundary.

Bt2—22 to 29 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 4/3) dry; moderate fine subangular blocky structure; friable; few fine roots; many distinct clay films; medium acid; clear smooth boundary.

Bt3—29 to 39 inches; brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable; few fine roots; many distinct clay films; medium acid; clear smooth boundary.

Bt4—39 to 47 inches; brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable; few fine roots; many distinct clay films; medium acid; clear smooth boundary.

Bt5—47 to 54 inches; brown (10YR 4/3) silt loam; few fine distinct gray (10YR 6/1) mottles; weak fine subangular blocky structure; friable; few fine roots; many faint clay films; medium acid; clear smooth boundary.

C—54 to 65 inches; dark yellowish brown (10YR 4/4) silt loam; few fine distinct light brownish gray (10YR 6/2), pale brown (10YR 6/3), and brown (10YR 5/3) mottles; massive; friable; medium acid.

The solum is 46 to 60 inches thick. The mollic epipedon is 24 to 36 inches thick. The soil ranges from medium acid to neutral.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. It commonly is silt loam in the upper part and silt loam or silty clay loam in the lower part. The B horizon has hue of 10YR, 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. It is silty clay loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is commonly silt loam, although in some pedons it is silty clay loam.

Snead Series

The Snead series consists of moderately deep, moderately well drained soils on uplands. Permeability is slow. These soils formed in residuum of interbedded shale and limestone. Slopes range from 5 to 30 percent.

Snead soils commonly are adjacent to Armster, Knox, and Ladoga soils on the landscape. These adjacent soils do not have a mollic epipedon and are on side slopes, in higher positions than Snead soils.

Typical pedon of Snead flaggy silty clay loam, in an area of Snead-Rock outcrop complex, 14 to 30 percent slopes, 2,900 feet east and 630 feet south of the northwest corner of sec. 30, T. 53 N., R. 33 W.

A1—0 to 4 inches; very dark gray (10YR 3/1) flaggy silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; many fine and few medium roots; 15 percent limestone flags; neutral; clear wavy boundary.

A2—4 to 11 inches; very dark grayish brown (10YR 3/2) flaggy silty clay loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to moderate very fine subangular blocky; firm; many fine and few medium roots; 30 percent limestone flags; neutral; clear smooth boundary.

Bw1—11 to 19 inches; dark grayish brown (2.5Y 4/2) flaggy silty clay; few fine distinct grayish brown (2.5Y 5/2) mottles; moderate fine subangular blocky structure; very firm; common fine and medium roots; l5 percent limestone flags; neutral; clear smooth boundary.

Bw2—19 to 25 inches; dark grayish brown (2.5Y 4/2) silty clay; few medium distinct olive brown (2.5Y 4/4) and few fine distinct light brownish gray (2.5Y 6/2) mottles; moderate fine subangular blocky structure; very firm; few fine roots; neutral; clear smooth boundary.

Cr—25 to 60 inches; soft grayish brown (2.5Y 5/2) shale; strong effervescence; mildly alkaline.

The solum ranges from 20 to 30 inches in thickness. Depth to weathered bedrock ranges from 20 to 40 inches. The solum is slightly acid or neutral in the upper part and neutral to moderately alkaline in the lower part.

The A horizon has hue of 10YR, value of 3, and chroma of 1 or 2. The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 2 to 4. Mottles have higher value and chroma. The B horizon is silty clay loam or silty clay and the flaggy analog. The Cr horizon has hue of 2.5Y or 5Y, value of 5, and chroma of 2 to 4.

Waldron Series

The Waldron series consists of deep, somewhat poorly drained soils on bottom lands of the Missouri River flood plain. Permeability is slow. These soils formed in stratified alluvium. Slopes range from 0 to 2 percent.

Waldron soils commonly are adjacent to Leta, Levasy, and Parkville soils. These adjacent soils are underlain by loamy material. Leta and Parkville soils are in slightly higher positions and Levasy soils in lower positions than Waldron soils.

Typical pedon in an area of Waldron silty clay loam, 2,950 feet west and 1,290 feet north of the southeast corner of sec. 29, T. 54 N., R. 36 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak fine granular; firm; few fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—8 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint gray (10YR 5/1) mottles; massive; firm; thin layer of grayish brown (10YR 5/2) sandy material at a depth of 10 inches; few fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

C2—18 to 28 inches; dark grayish brown (10YR 4/2) silty clay loam; few medium distinct dark yellowish brown (10YR 3/6) mottles; massive; firm; few thin strata or lenses of grayish brown (10YR 5/2) and brown (10YR 5/3) fine sandy loam; few fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

C3—28 to 60 inches; dark gray (10YR 4/1) silty clay loam; few medium prominent dark reddish brown (5YR 3/3) mottles; massive; firm; few fine roots; slight effervescence; mildly alkaline.

Free carbonates are within 10 inches of the surface.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. The C horizon has hue of 10YR or 2.5Y, value of 2 to 5, and chroma of 1 to 3. The 10- to 40-inch control section averages between 35 and 50 percent clay. Strata less than 6 inches thick of finer or coarser material are common in the control section.

Wiota Series

The Wiota series consists of deep, well drained soils on low terraces. Permeability is moderate. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Wiota soils are similar to Sibley soils and commonly are adjacent to Bremer, Colo, and Nodaway soils on the landscape. Bremer soils are grayer, have more clay, and are in slightly lower positions than Wiota soils. Colo and Nodaway soils do not have an argillic horizon and are on flood plains in lower positions than Wiota soils. Sibley soils have less fine and coarse sand in the solum and are on uplands.

Typical pedon in an area of Wiota silt loam, about 1,800 feet north and 500 feet east of the southwest corner of sec. 32, T. 54 N., R. 33 W.

Ap—0 to 7 inches; black (10YR 2/1) silt loam, dark brown (10YR 3/3) dry; moderate very fine granular structure; friable; few fine roots; neutral; abrupt smooth boundary.

A1—7 to 13 inches; black (10YR 2/1) silt loam, very dark grayish brown (10YR 3/2) dry; weak very fine platy structure parting to weak very fine angular blocky; friable; few fine roots; neutral; clear smooth boundary.

AB—13 to 22 inches; black (10YR 2/1) silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate very fine subangular blocky structure; friable; few very fine roots; common fine and very fine tubular pores; neutral; clear smooth boundary.

Bt1—22 to 31 inches; very dark grayish brown (10YR 3/2) silty clay loam, brown (10YR 4/3) dry; weak fine and medium subangular blocky structure; friable; few very fine roots; common fine and very fine tubular pores; many faint clay films; black (10YR 2/1) coatings on faces of peds; neutral; clear smooth boundary.

Bt2—31 to 41 inches; brown (10YR 4/3) silty clay loam; moderate medium columnar structure parting to moderate medium subangular blocky; firm; few very fine roots; few fine and very fine tubular pores; common faint clay films; black (10YR 2/1) coatings on some faces of peds; neutral; clear smooth boundary.

Bt3—41 to 55 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium columnar structure parting to weak medium subangular blocky; firm; few very fine roots; few fine and very fine tubular pores; common faint thin discontinuous clay films; very dark grayish brown (10YR 3/2) coatings on some faces of peds; neutral; gradual smooth boundary.

C—55 to 71 inches; dark yellowish brown (10YR 4/4) silty clay loam; massive; firm; slightly acid.

The solum is 36 to 60 inches thick. The mollic epipedon is 18 to 32 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. In some pedons the upper part has value of 3 and chroma of 3. The Bt horizon is silty clay loam that is 32 to 36 percent clay. The C horizon is similar in color and texture to the Bt horizon. Some pedons have mottles that have high chroma as well as some that have low chroma.

Formation of the Soils

This section describes the factors of soil formation and relates these factors to the formation of the soils in Platte County.

Factors of Soil Formation

Soil is the product of soil-forming processes acting on accumulated or deposited geologic materials. The characteristics of the soil at any given point are determined by (1) the type of parent material, (2) plant and animal life on and in the soil, (3) the climate under which the soil material accumulated, (4) the relief, or topography, of the land, and (5) the length of time the forces of soil formation have been active.

Parent material affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Plant and animal life, chiefly plants, are the active factors in soil formation. Climate determines the amount of water available for leaching and the amount of heat available for physical and chemical changes. Together, climate and plant and animal life act on the parent material that has accumulated and slowly change it to a natural body that has genetically related horizons. Relief modifies the effects of climate and plant and animal life. Finally, time is needed to change the parent material into a soil profile. Generally, a long time is required for the development of distinct soil horizons.

The factors of soil formation are so closely interrelated in their effect on the soil that few generalizations can be made about the effect of any one factor unless conditions are specified about the other four. Soil formation is complex, and many of the processes of soil development are still unknown.

Parent Material

Parent material is the unconsolidated mass from which soil is formed. The formation or the deposition of this material is the first step in the development of a soil profile. The characteristics of the material determine the limits of chemical and mineralogical composition of the soil. In Platte County four kinds of parent materials, alone or in combination, have contributed to the formation of the soils. These parent materials are residual material weathered from bedrock, glacial material, loess or wind-deposited material, and alluvial or water-deposited material.

Platte County has two types of residual material. Snead soils formed in residuum of shale interbedded with thin layers of limestone. Basehor soils formed in residuum of sandstone.

Glacial parent material was transported by ice action and is composed of clay, silt, sand, gravel, and a few boulders. Much of the glacial till was moved a long distance, although some is of local origin. Armster soils formed in glacial till.

Loess, a silty material transported by wind, is the most extensive parent material in Platte County. The principal source of loess is believed to be the flood plain of the Missouri River during the period after the retreat of the last glacier. The deepest deposits of loess are in the hills bordering the flood plain. Knox and Sibley soils formed in this area. As the distance from the source increased, the deposits became thinner and contained more clay. Finer loess and gentler slopes resulted in soils that have more restricted drainage. Sharpsburg, Higginsville, and Ladoga soils formed in the finer loess.

Alluvium is material that was transported by water and deposited on nearly level flood plains. This material varies greatly in texture and mineralogical composition, reflecting the diverse origin and varying speed of the flowing water. Parent material on flood plains of small tributary streams derives from the local uplands. Kennebec, Nodaway, Colo, and Wiota soils reflect the high silt content of the surrounding loess-capped uplands. The vast drainage area of the Missouri River provides the parent material for the soils that form on the flood plain. These soils reflect the varying speed of the flowing water. Haynie and Sarpy soils formed in material deposited by swiftly flowing water and are coarser than Leta, Levasy, and Waldron soils, which formed in material deposited in slack water areas.

Plant and Animal Life

Plants and animals living on or in the soil are active in the process of soil formation. Plants furnish organic matter to the soil and bring up plant nutrients from underlying layers to the surface layer. As plants die and decay, they contribute organic matter to the soil. Bacteria and fungi decompose plant remains and help incorporate the organic matter into the soil.

The kind of native vegetation, prairie grasses or forest trees, has greatly influenced soil formation in Platte County. Soils that form under prairie grasses accumulate organic matter mainly through the yearly decomposition of plant materials. Plant tops decompose at the surface, and the roots decompose at various depths in the soil. As a result, soils that formed under prairie grasses have a thick, dark colored surface layer. Sibley, Sharpsburg, and Higginsville soils are prairie soils.

Soils that form under forest accumulate organic matter mostly through leaves and twigs decomposing on the surface. Consequently, forest soils have a thin, dark colored surface layer. Basehor soils are forest soils.

Insects, worms, animals, and man affect the soil. Bacteria and fungi contribute more towards soil formation than do animals. They cause rotting of organic materials, fix nitrogen, and improve tilth. Burrowing animals and insects loosen and mix the various soil horizons.

Man, in a short time, has greatly affected soil formation in Platte County, causing changes in vegetation, drainage, and accelerated erosion. Row crops have replaced native grasses. Nearly all of the flood plains and much of the upland areas are now farmed. Food production has increased; however, in terms of sustained productivity, the changes have been adverse. Accelerated erosion continues to reduce the potential of many of the upland soils, and the loss of cropland to urban development is virtually irreversible.

Climate

Climate has been and still is an important factor in soil formation. Geologic erosion, plant and animal life, and in more recent times, accelerated erosion, all have varied according to the climate. Present climatic conditions tend to favor forested conditions rather than the prairie grasses. The remaining prairie areas in Platte County are the result of a more arid climatic cycle.

The glacial periods which so greatly affected the processes of soil formation were the result of climatic changes. Thousands of years of cold temperatures resulted in glaciers that moved into the area. Warmer weather and high winds caused severe geologic erosion, and consequently most of Platte County was covered by loess.

High temperatures and adequate rainfall encourage rapid chemical and physical changes. A climate characterized by these qualities is conducive to the breakdown of minerals and the formation of clay within the soil. The clay is moved downward in the soil profile, forming a clayey subsoil. Nearly all of the upland soils in Platte County show evidence of the eluviation of clay.

Relief

Relief, or the lay of the land, affects soil formation through its influence on drainage, runoff, infiltration, and accelerated erosion. Relief consists of the length, shape, aspect, and percent of the slope of the landscape and is important in determining the pattern and distribution of soils.

The amount of water that enters the soil depends on steepness of slope, degree of permeability, and intensity of rainfall. Because runoff is rapid on steep slopes, very little water passes through the soil, and soil formation is slow. Geologic erosion almost keeps pace with the process of soil formation. However, in gently sloping areas, erosion is minimal, runoff is slow, and most of the water passes through the soil. Leaching, translocation of clay, and other soil-forming processes are intensified, and the soil shows maximum profile development.

Steep, south-facing slopes receive more direct sunrays and are more droughty than similar material on north-facing slopes. Droughtiness influences soil formation through its effect on kinds of vegetation, erosion, and freezing and thawing.

Time

The degree of profile development is dependent on the length of time that the parent material has been in place and subject to the processes of soil formation. Age of a soil is determined by the degree of development of a soil profile. It is the result of the interaction of the processes of soil formation over a period of time and is not simply the number of years the material has existed. Older soils show the effects of leaching and clay movement and have distinct horizons. Young soils show little profile development.

The youngest soils in Platte County are alluvial soils. Nodaway soils show no profile development because alluvial material is added nearly every year. Bremer and Wiota soils, on stream terraces, are the oldest alluvial soils.

The oldest soils are those that formed in loess and till in the highest positions on the landscape. Armster and Sharpsburg soils show development of distinct horizons. Clay has accumulated in distinct subsoil horizons, both through weathering and translocation by water.

Basehor and Snead soils are steep and shallower and formed in shale and sandstone residuum. The shale and sandstone from which their parent material formed is much older than the parent material of the other soils. However, the removal of materials through geological erosion nearly keeps pace with the processes of soil formation. Thus, these soils are considered young.

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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—

	Inches
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.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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.

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.

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.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective layer 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.

Deferred grazing. Postponing grazing or resting grazingland 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 wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

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 of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

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.

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, and 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 37.5 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.

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.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

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.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

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.

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 upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, alluminum, 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) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

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 A or B 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, the Arabic numeral 2 precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock 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—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

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 the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

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.

Open space. A relatively undeveloped green or wooded area provided mainly within an urban area to minimize feelings of congested living.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

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 degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0

Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

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.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

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-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

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.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
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, B, and E horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 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. 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.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

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 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 1951-79 at Kansas City, Missouri]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	37.8	19.8	28.8	69	-6	0	1.17	0.28	1.87	3	6.9
February---	43.5	25.1	34.3	73	-1	10	1.28	.57	1.88	4	4.1
March------	52.7	32.8	42.8	84	9	65	2.51	1.19	3.64	6	5.1
April------	66.6	45.7	56.2	89	26	217	3.34	1.94	4.58	7	.7
May--------	76.6	56.8	66.7	93	37	518	4.12	2.89	5.25	7	.0
June-------	85.0	66.3	75.7	99	50	771	5.18	2.77	7.30	8	.0
July-------	89.2	70.8	80.0	103	56	930	4.42	1.54	6.80	7	.0
August-----	88.5	69.2	78.9	103	55	896	3.69	1.37	5.62	6	.0
September--	81.2	60.7	71.0	98	42	630	4.08	1.17	6.42	6	.0
October----	70.3	49.5	59.9	91	30	333	3.02	.94	4.71	5	.0
November---	54.8	35.9	45.4	78	14	46	1.56	.26	2.54	3	.9
December---	42.8	26.2	34.5	68	0	12	1.38	.48	2.12	4	4.5
Yearly:											
Average--	65.8	46.6	56.2	---	---	---	---	---	---	---	---
Extreme--	---	---	---	104	-6	---	---	---	---	---	---
Total----	---	---	---	---	---	4,428	35.75	27.58	44.29	66	22.2

[1] 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° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-79 at Kansas City, 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--	April 14	April 28	May 8
2 years in 10 later than--	April 3	April 17	April 25
5 years in 10 later than--	March 13	March 25	April 2
First freezing temperature in fall:			
1 year in 10 earlier than--	October 31	October 26	October 16
2 years in 10 earlier than--	November 6	October 30	October 21
5 years in 10 earlier than--	November 18	November 6	October 31

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-79 at Kansas City, Missouri]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	220	201	185
8 years in 10	228	207	192
5 years in 10	244	220	206
2 years in 10	260	232	220
1 year in 10	268	239	227

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1B	Sibley silt loam, 2 to 5 percent slopes	7,500	2.8
1C	Sibley silt loam, 5 to 9 percent slopes	9,175	3.4
2C2	Higginsville silt loam, 5 to 9 percent slopes, eroded	16,480	6.1
6B	Sharpsburg silt loam, 2 to 5 percent slopes	9,080	3.4
6C2	Sharpsburg silt loam, 5 to 9 percent slopes, eroded	20,970	7.8
6D2	Sharpsburg silt loam, 9 to 14 percent slopes, eroded	11,545	4.3
8	Pits, quarries	147	0.1
10D	Snead-Rock outcrop complex, 5 to 14 percent slopes	10,260	3.8
10F	Snead-Rock outcrop complex, 14 to 30 percent slopes	16,875	6.2
26B	Ladoga silt loam, 2 to 5 percent slopes	3,400	1.3
26C2	Ladoga silt loam, 5 to 9 percent slopes, eroded	6,900	2.6
26D2	Ladoga silt loam, 9 to 14 percent slopes, eroded	10,160	3.7
30	Kennebec silt loam	8,390	3.1
31	Colo silt loam	4,735	1.7
36	Bremer silt loam	2,070	0.8
38	Wiota silt loam	5,030	1.9
39	Nodaway silt loam	13,020	4.8
41D2	Armster loam, 8 to 14 percent slopes, eroded	7,790	2.9
48D	Basehor loam, 5 to 14 percent slopes	1,725	0.6
54C2	Knox silt loam, 5 to 9 percent slopes, eroded	10,460	3.9
54F2	Knox silt loam, 20 to 30 percent slopes, eroded	6,900	2.6
55D3	Knox silty clay loam, 5 to 14 percent slopes, severely eroded	14,600	5.4
55E3	Knox silty clay loam, 14 to 20 percent slopes, severely eroded	26,400	9.8
61C	Knox-Urban land complex, 5 to 9 percent slopes	817	0.3
61D	Knox-Urban land complex, 9 to 14 percent slopes	2,220	0.8
72	Dockery silt loam	2,370	0.9
73	Leta silty clay	4,640	1.7
74	Levasy silty clay	1,725	0.6
81	Waldron silty clay loam	2,765	1.0
82	Parkville silty clay loam	8,880	3.3
84	Haynie silt loam, clayey substratum	18,250	6.8
86	Haynie Variant silt loam	1,875	0.7
99	Sarpy fine sandy loam	286	0.1
104	Udorthents-Urban land complex	2,070	0.8
	Total land area	269,510	100.0
	Water areas greater than 40 acres in size	3,968	
	Total area	273,478	

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas 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
1B	Sibley silt loam, 2 to 5 percent slopes
1C	Sibley silt loam, 5 to 9 percent slopes
6B	Sharpsburg silt loam, 2 to 5 percent slopes
26B	Ladoga silt loam, 2 to 5 percent slopes
30	Kennebec silt loam (where protected from flooding)
31	Colo silt loam (where drained and protected from flooding)
36	Bremer silt loam (where drained)
38	Wiota silt loam
39	Nodaway silt loam (where protected from flooding)
72	Dockery silt loam (where protected from flooding)
73	Leta silty clay
74	Levasy silty clay (where drained)
81	Waldron silty clay loam (where drained)
82	Parkville silty clay loam
84	Haynie silt loam, clayey substratum
86	Haynie Variant silt loam

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Grass-legume hay	Smooth bromegrass
		Bu	Bu	Bu	Bu	Tons	AUM*
1B-----Sibley	IIe	115	45	95	48	4.8	10.0
1C-----Sibley	IIIe	108	39	85	40	4.5	9.6
2C2-----Higginsville	IIIe	108	39	94	43	4.6	9.6
6B-----Sharpsburg	IIe	102	43	88	45	4.5	9.0
6C2-----Sharpsburg	IIIe	90	40	80	42	4.0	8.0
6D2-----Sharpsburg	IIIe	82	30	70	34	3.7	7.4
8. Pits							
10D-----Snead-Rock outcrop	VIs	---	---	---	---	---	---
10F-----Snead-Rock outcrop	VIIs	---	---	---	---	---	---
26B-----Ladoga	IIe	92	35	76	39	4.1	8.0
26C2-----Ladoga	IIIe	80	30	68	33	3.8	7.2
26D2-----Ladoga	IIIe	70	26	58	28	3.2	6.0
30-----Kennebec	IIw	100	38	86	30	3.3	9.0
31-----Colo	IIIw	80	35	80	---	5.3	---
36-----Bremer	IIw	96	36	83	40	4.3	---
38-----Wiota	I	110	42	95	46	4.9	9.6
39-----Nodaway	IIw	80	30	70	---	3.7	7.4
41D2-----Armster	IVe	50	22	45	25	2.3	4.6
48D-----Basehor	VIe	---	---	---	---	---	2.5
54C2-----Knox	IIIe	80	29	80	34	3.7	7.4
54F2-----Knox	VIe	---	---	---	---	2.5	5.0

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Grass-legume hay	Smooth bromegrass
		Bu	Bu	Bu	Bu	Tons	AUM*
55D3------------- Knox	IVe	65	22	55	30	2.8	6.0
55E3------------- Knox	VIe	---	---	---	---	2.8	5.6
61C-------------- Knox-Urban land	---	---	---	---	---	---	---
61D-------------- Knox-Urban land	---	---	---	---	---	---	---
72--------------- Dockery	IIIw	85	32	74	36	3.8	7.4
73--------------- Leta	IIw	88	32	75	35	3.8	7.4
74--------------- Levasy	IIIw	78	30	65	30	3.5	---
81--------------- Waldron	IIw	80	30	68	33	3.6	7.0
82--------------- Parkville	IIw	96	38	88	42	4.5	8.0
84--------------- Haynie	IIw	96	36	85	38	3.6	8.6
86--------------- Haynie Variant	IIw	96	36	88	40	3.6	8.6
99--------------- Sarpy	IVs	---	---	---	15	0.9	1.8
104-------------- Udorthents-Urban land	---	---	---	---	---	---	---

* 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.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
10D*:									
Snead	4x	Slight	Moderate	Severe	Severe	Slight	Northern red oak White oak White ash Sugar maple	62 55 56 ---	Eastern cottonwood, silver maple, white ash, northern red oak.
Rock outcrop:									
10F*:									
Snead	4x	Moderate	Moderate	Severe	Severe	Slight	Northern red oak White oak White ash Sugar maple	62 55 56 ---	Eastern cottonwood, silver maple, white ash, northern red oak.
Rock outcrop.									
26B, 26C2, 26D2 Ladoga	2o	Slight	Slight	Slight	Slight	Moderate	White oak Northern red oak	75 75	Eastern white pine, white oak, sugar maple, northern red oak, black walnut.
30 Kennebec	2o	Slight	Slight	Slight	Slight	Moderate	Black walnut Bur oak Hackberry Green ash Eastern cottonwood	79 63 --- --- ---	Black walnut, green ash, eastern cottonwood, American sycamore.
36 Bremer	3w	Slight	Severe	Moderate	Moderate	Severe	Eastern cottonwood Silver maple	90 80	American sycamore, hackberry, green ash, eastern cottonwood, silver maple.
39 Nodaway	2o	Slight	Slight	Slight	Slight	Moderate	White oak Black walnut	75 76	Eastern white pine, black walnut, sugar maple.
41D2 Armster	4o	Slight	Slight	Slight	Slight	Slight	Pin oak White oak Northern red oak	70 57 58	Pin oak, green ash, northern red oak, white oak, black oak.
48D Basehor	5d	Slight	Slight	Moderate	Moderate	Slight	White oak Northern red oak Hackberry White ash	45 40 45 45	Hackberry, white ash.
54C2 Knox	3o	Slight	Slight	Slight	Slight	Slight	White oak Black oak Northern red oak	65 74 ---	Eastern white pine, green ash, black walnut, yellow-poplar.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortal-ity	Wind-throw hazard	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
54F2---------------- Knox	3r	Moderate	Moderate	Moderate	Slight	Slight	White oak------------ Black oak------------ Northern red oak----	65 74 ---	Eastern white pine, green ash, black walnut, yellow-poplar.
55D3---------------- Knox	3o	Slight	Slight	Slight	Slight	Slight	White oak------------ Black oak------------ Northern red oak----	65 74 ---	Eastern white pine, green ash, black walnut, yellow-poplar.
55E3---------------- Knox	3r	Moderate	Moderate	Moderate	Slight	Slight	White oak------------ Black oak------------ Northern red oak----	65 74 ---	Eastern white pine, green ash, black walnut, yellow-poplar.
72------------------ Dockery	3o	Slight	Slight	Slight	Slight	Slight	Pin oak--------------	76	Pin oak, pecan, eastern cottonwood.
73------------------ Leta	3c	Slight	Moderate	Severe	Severe	Slight	Eastern cottonwood-- Black willow--------- Pin oak--------------	90 --- 76	Sweetgum, pecan, eastern cottonwood, silver maple, green ash.
74------------------ Levasy	3w	Slight	Severe	Moderate	Severe	Severe	Eastern cottonwood-- Black willow---------	90 ---	Eastern cottonwood, pecan.
81------------------ Waldron	2c	Slight	Moderate	Severe	Severe	Slight	Eastern cottonwood--	110	Pecan, eastern cottonwood, green ash, silver maple.
82------------------ Parkville	2c	Slight	Moderate	Severe	Severe	Moderate	Eastern cottonwood--	100	Eastern cottonwood, pecan, American sycamore.
84------------------ Haynie	1o	Slight	Slight	Slight	Slight	Moderate	Eastern cottonwood-- American sycamore--- Black walnut-------- Green ash-----------	110 110 --- ---	Black walnut, eastern cottonwood, green ash.
86------------------ Haynie Variant	1o	Slight	Slight	Slight	Slight	Moderate	Eastern cottonwood-- American sycamore--- Black walnut-------- Green ash-----------	110 110 --- ---	Black walnut, eastern cottonwood, green ash.
99------------------ Sarpy	3s	Slight	Slight	Severe	Slight	Slight	Eastern cottonwood-- Silver maple--------	95 90	Eastern cottonwood, American sycamore, silver maple.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1B, 1C------------ Sibley	---	Amur maple, Amur honeysuckle, lilac, autumn-olive.	Green ash, eastern redcedar, hackberry, bur oak, Russian-olive.	Eastern white pine, honeylocust, Austrian pine.	---
2C2---------------- Higginsville	---	Amur honeysuckle, lilac, autumn-olive, Amur maple.	Eastern redcedar	Austrian pine, eastern white pine, honeylocust, hackberry, green ash, pin oak.	Eastern cottonwood.
6B, 6C2, 6D2------ Sharpsburg	---	Amur maple, Amur honeysuckle, lilac, autumn-olive.	Green ash, hackberry, bur oak, eastern redcedar, Russian-olive.	Austrian pine, eastern white pine, honeylocust.	---
8*. Pits					
10D*, 10F*: Snead.					
Rock outcrop.					
26B, 26C2, 26D2--- Ladoga	---	Lilac, Amur honeysuckle, autumn-olive, Amur maple.	Eastern redcedar, hackberry, green ash, bur oak, Russian-olive.	Austrian pine, eastern white pine, honeylocust.	---
30---------------- Kennebec	---	Amur maple, Amur honeysuckle, lilac, autumn-olive.	Eastern redcedar	Austrian pine, hackberry, pin oak, green ash, honeylocust.	Eastern white pine, eastern cottonwood.
31---------------- Colo	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Austrian pine, green ash, northern red oak, golden willow, honeylocust, silver maple, eastern cottonwood.	---
36---------------- Bremer	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Austrian pine, honeylocust, green ash, silver maple, golden willow, northern red oak.	Eastern cottonwood.
38---------------- Wiota	---	Lilac, Amur honeysuckle, autumn-olive, Amur maple.	Eastern redcedar, hackberry, green ash, bur oak, Russian-olive.	Austrian pine, eastern white pine, honeylocust.	---
39---------------- 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
41D2: Armster	---	Lilac, autumn-olive, Amur honeysuckle, Amur maple.	Eastern redcedar, hackberry, green ash, bur oak, Russian-olive.	Austrian pine, eastern white pine, honeylocust.	---
48D. Basehor					
54C2, 54F2, 55D3, 55E3: Knox	---	Amur honeysuckle, autumn-olive, lilac, Amur maple.	Hackberry, eastern redcedar, green ash, bur oak, Russian-olive.	Austrian pine, eastern white pine, honeylocust.	---
61C*, 61D*: Knox	---	Amur honeysuckle, autumn-olive, lilac, Amur maple.	Hackberry, eastern redcedar, green ash, bur oak, Russian-olive.	Austrian pine, eastern white pine, honeylocust.	---
Urban land.					
72: Dockery	---	Amur honeysuckle, lilac, autumn-olive, Amur maple.	Eastern redcedar, pin oak.	Austrian pine, eastern white pine, honeylocust, hackberry, green ash.	Eastern cottonwood.
73: Leta	Blackhaw	Tatarian honeysuckle, Siberian peashrub.	Eastern redcedar, osageorange, Russian-olive, Washington hawthorn.	Honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.
74: Levasy	---	American plum, common chokecherry.	White spruce, Manchurian crabapple, hackberry, eastern redcedar.	Russian mulberry, Austrian pine, green ash, golden willow, honeylocust.	Eastern cottonwood.
81: Waldron	Blackhaw	Tatarian honeysuckle, Siberian peashrub.	Eastern redcedar, Russian-olive, osageorange, Washington hawthorn.	Honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.
82: Parkville	Blackhaw	Tatarian honeysuckle, Siberian peashrub.	Eastern redcedar, Russian-olive, osageorange, Washington hawthorn.	Honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.
84: Haynie	Blackhaw	Tatarian honeysuckle, Siberian peashrub.	Russian-olive, osageorange, eastern redcedar, Washington hawthorn.	Green ash, hackberry, honeylocust, bur oak.	Eastern cottonwood.
86: Haynie Variant	Blackhaw	Tatarian honeysuckle, Siberian peashrub.	Russian-olive, Washington hawthorn, eastern redcedar, osageorange.	Bur oak, green ash, hackberry, honeylocust.	Eastern cottonwood.
99: Sarpy	Blackhaw	Tatarian honeysuckle, Siberian peashrub.	Washington hawthorn, Russian-olive, eastern redcedar, osageorange.	Hackberry, green ash, honeylocust, bur 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
104*:					
Udorthents.					
Urban land.					

* 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
1B----- Sibley	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
1C----- Sibley	Slight-----	Slight-----	Severe: slope.	Slight-----	Slight.
2C2----- Higginsville	Moderate: wetness.	Moderate: wetness.	Severe: slope.	Moderate: wetness.	Moderate: wetness.
6B----- Sharpsburg	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight-----	Slight.
6C2----- Sharpsburg	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight-----	Slight.
6D2----- Sharpsburg	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight-----	Moderate: slope.
8*. Pits					
10D*:					
Snead-----	Moderate: large stones, slope.	Moderate: large stones, slope, wetness.	Severe: large stones, slope, small stones.	Moderate: large stones.	Severe: large stones.
Rock outcrop.					
10F*:					
Snead-----	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: large stones, slope.
Rock outcrop.					
26B----- Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight-----	Slight.
26C2----- Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight-----	Slight.
26D2----- Ladoga	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight-----	Moderate: slope.
30----- Kennebec	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
31----- Colo	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: flooding, wetness.	Severe: flooding.
36----- Bremer	Severe: wetness, flooding.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
38: Wiota	Severe: flooding.	Slight	Slight	Slight	Slight.
39: Nodaway	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
41D2: Armster	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
48D: Basehor	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight	Severe: thin layer.
54C2: Knox	Slight	Slight	Severe: slope.	Slight	Slight.
54F2: Knox	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
55D3: Knox	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
55E3: Knox	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
61C*:					
Knox	Slight	Slight	Severe: slope.	Slight	Slight.
Urban land.					
61D*:					
Knox	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Urban land.					
72: Dockery	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
73: Leta	Severe: flooding, wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
74: Levasy	Severe: flooding, ponding, too clayey.	Severe: ponding, too clayey.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
81: Waldron	Severe: wetness, flooding.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
82: Parkville	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
84: Haynie	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
86: Haynie Variant	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.	Moderate: flooding.
99: Sarpy	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: droughty, flooding.
104*:					
Udorthents.					
Urban land.					

* 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 herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1B: Sibley	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
1C: Sibley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
2C2: Higginsville	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
6B: Sharpsburg	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
6C2, 6D2: Sharpsburg	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
8*. Pits										
10D*:										
Snead	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
10F*:										
Snead	Very poor.	Very poor.	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
26B: Ladoga	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
26C2, 26D2: Ladoga	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
30: Kennebec	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
31: Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
36: Bremer	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
38: Wiota	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
39: Nodaway	Poor	Fair	Fair	Poor	Poor	Good	Fair	Poor	Poor	Fair.
41D2: Armster	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
48D: Basehor	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
54C2: Knox	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
54F2: Knox	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
55D3: Knox	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
55E3: Knox	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
61C*, 61D*:										
Knox	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Urban land.										
72: Dockery	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
73: Leta	Fair	Fair	Poor	Good	Good	Poor	Fair	Fair	Fair	Poor.
74: Levasy	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
81: Waldron	Fair	Fair	Fair	Good	Good	Poor	Fair	Fair	Fair	Poor.
82: Parkville	Poor	Fair	Fair	Good	Good	Poor	Fair	Fair	Good	Poor.
84: Haynie	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
86: Haynie Variant	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
99: Sarpy	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
104*:										
Udorthents.										
Urban land.										

* 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
1B----------------- Sibley	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
1C----------------- Sibley	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
2C2---------------- Higginsville	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: wetness.
6B----------------- Sharpsburg	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
6C2---------------- Sharpsburg	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
6D2---------------- Sharpsburg	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
8*. Pits						
10D*: Snead------------	Severe: wetness.	Severe: shrink-swell.	Severe: wetness.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: large stones.
Rock outcrop.						
10F*: Snead------------	Severe: wetness, slope.	Severe: shrink-swell, slope.	Severe: wetness, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: large stones, slope.
Rock outcrop.						
26B---------------- Ladoga	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
26C2--------------- Ladoga	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
26D2--------------- Ladoga	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
30----------------- Kennebec	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Severe: flooding.
31----------------- Colo	Severe: wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, low strength, frost action.	Severe: flooding.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
36---------------- Bremer	Severe: wetness.	Severe: wetness, shrink-swell, flooding.	Severe: wetness, shrink-swell, flooding.	Severe: wetness, shrink-swell, flooding.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
38---------------- Wiota	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
39---------------- Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Severe: flooding.
41D2-------------- Armster	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
48D--------------- Basehor	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: thin layer.
54C2-------------- Knox	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
54F2-------------- Knox	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
55D3-------------- Knox	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
55E3-------------- Knox	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
61C*:						
Knox-------------	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
Urban land.						
61D*:						
Knox-------------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Urban land.						
72---------------- Dockery	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.	Severe: flooding.
73---------------- Leta	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, frost action.	Severe: too clayey.
74---------------- Levasy	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, flooding.	Severe: ponding, too clayey.

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
81----------------- Waldron	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
82----------------- Parkville	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.
84----------------- Haynie	Moderate: too clayey, wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
86----------------- Haynie Variant	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
99----------------- Sarpy	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
104*: Udorthents.						
Urban land.						

* 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
1B------------------ Sibley	Slight-----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
1C------------------ Sibley	Slight-----------	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
2C2----------------- Higginsville	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
6B------------------ Sharpsburg	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
6C2----------------- Sharpsburg	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
6D2----------------- Sharpsburg	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
8*. Pits					
10D*: Snead--------------	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope, wetness.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Rock outcrop.					
10F*: Snead--------------	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope, wetness.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Rock outcrop.					
26B----------------- Ladoga	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
26C2---------------- Ladoga	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
26D2---------------- Ladoga	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
30------------------ Kennebec	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
31------------------ Colo	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Poor: wetness, hard to pack.

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
36 Bremer	Severe: percs slowly, flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Poor: wetness.
38 Wiota	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
39 Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
41D2 Armster	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
48D Basehor	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock, seepage.	Poor: area reclaim.
54C2 Knox	Slight	Severe: slope.	Slight	Slight	Good.
54F2 Knox	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
55D3 Knox	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
55E3 Knox	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
61C*:					
Knox	Slight	Severe: slope.	Slight	Slight	Good.
Urban land.					
61D*:					
Knox	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Urban land.					
72 Dockery	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
73 Leta	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
74 Levasy	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.
81 Waldron	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
82 Parkville	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: 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
84------------------- Haynie	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: thin layer.
86------------------- Haynie Variant	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
99------------------- Sarpy	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
104*:					
Udorthents.					
Urban land.					

* 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
1B, 1C Sibley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
2C2 Higginsville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
6B, 6C2, 6D2 Sharpsburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
8*. Pits				
10D*, 10F*:				
Snead	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.
Rock outcrop.				
26B, 26C2, 26D2 Ladoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
30 Kennebec	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
31 Colo	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
36 Bremer	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
38 Wiota	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
39 Nodaway	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
41D2 Armster	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
48D Basehor	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
54C2 Knox	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
54F2 Knox	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
55D3 Knox	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
55E3 Knox	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
61C*:				
Knox	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land.				
61D*:				
Knox	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
Urban land.				
72 Dockery	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
73 Leta	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
74 Levasy	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
81 Waldron	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
82 Parkville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
84 Haynie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
86 Haynie Variant	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
99 Sarpy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
104*:				
Udorthents.				
Urban land.				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
1B, 1C: Sibley	Moderate: seepage, slope.	Slight	Deep to water	Slope	Favorable	Favorable.
2C2: Higginsville	Moderate: seepage, slope.	Moderate: wetness.	Frost action, slope.	Wetness, slope, erodes easily.	Erodes easily, wetness.	Erodes easily.
6B, 6C2: Sharpsburg	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
6D2: Sharpsburg	Severe: slope.	Slight	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
8*. Pits						
10D*, 10F*:						
Snead	Severe: slope.	Severe: large stones.	Percs slowly, depth to rock, large stones.	Large stones, wetness.	Slope, large stones, depth to rock.	Large stones, slope.
Rock outcrop.						
26B, 26C2: Ladoga	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Slope	Erodes easily	Erodes easily.
26D2: Ladoga	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
30: Kennebec	Moderate: seepage.	Moderate: thin layer, piping, wetness.	Deep to water	Flooding	Favorable	Favorable.
31: Colo	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Flooding, wetness.	Wetness	Wetness.
36: Bremer	Slight	Severe: wetness, hard to pack.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
38: Wiota	Moderate: seepage.	Slight	Deep to water	Favorable	Erodes easily	Erodes easily.
39: Nodaway	Moderate: seepage.	Severe: piping.	Deep to water	Flooding, erodes easily.	Erodes easily	Erodes easily.
41D2: Armster	Severe: slope.	Moderate: hard to pack, wetness.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
48D: Basehor	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
54C2: Knox	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
54F2, 55D3, 55E3: Knox	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, 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
61C*:						
Knox	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Urban land.						
61D*:						
Knox	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Urban land.						
72 Dockery	Moderate: seepage.	Moderate: piping, wetness.	Flooding, frost action.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Erodes easily.
73 Leta	Moderate: seepage.	Severe: piping, wetness.	Percs slowly, flooding, frost action.	Wetness, slow intake, percs slowly.	Wetness	Wetness, percs slowly.
74 Levasy	Moderate: seepage.	Severe: piping, ponding.	Ponding, percs slowly, flooding.	Ponding, slow intake, percs slowly.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.
81 Waldron	Slight	Severe: hard to pack.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
82 Parkville	Moderate: seepage.	Severe: piping, wetness.	Percs slowly, flooding, cutbanks cave.	Wetness, percs slowly.	Wetness	Wetness, percs slowly.
84 Haynie	Moderate: seepage.	Severe: piping.	Deep to water	Percs slowly, erodes easily, flooding.	Erodes easily	Erodes easily.
86 Haynie Variant	Moderate: seepage.	Severe: piping.	Flooding, frost action.	Wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
99 Sarpy	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
104*:						
Udorthents.						
Urban land.						

* 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		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1B, 1C----------- Sibley	0-16	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	30-40	10-20
	16-47	Silty clay loam	CL, CH, MH	A-7	0	100	100	95-100	90-100	40-55	20-35
	47-65	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-45	15-25
2C2-------------- Higginsville	0-8	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	30-40	10-15
	8-13	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	13-42	Silty clay loam	CL	A-7	0	100	100	95-100	90-100	40-50	15-25
	42-60	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	90-100	35-45	10-20
6B--------------- Sharpsburg	0-13	Silt loam--------	CL	A-6	0	100	100	100	95-100	25-40	10-20
	13-26	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-60	20-35
	26-55	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
	55-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
6C2, 6D2--------- Sharpsburg	0-7	Silt loam--------	CL	A-6	0	100	100	100	95-100	25-40	10-20
	7-26	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-60	20-35
	26-54	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
	54-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
8*. Pits											
10D*, 10F*: Snead-----------	0-11	Flaggy silty clay loam.	CL, CH	A-7, A-6	10-40	70-90	60-85	55-80	50-75	35-55	20-35
	11-19	Flaggy silty clay, flaggy clay, stony silty clay.	CH, CL	A-7	10-50	70-90	60-85	55-80	50-75	45-60	25-40
	19-25	Silty clay, clay	CH, CL	A-7	0-10	90-100	90-100	90-100	80-100	45-60	25-40
	25-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
26B, 26C2, 26D2-- Ladoga	0-9	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	9-40	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	40-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
30--------------- Kennebec	0-35	Silt loam--------	CL	A-6, A-7	0	100	100	95-100	90-100	25-45	10-20
	35-60	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	95-100	90-100	25-40	5-15
31--------------- Colo	0-6	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	6-45	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	45-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
36--------------- Bremer	0-17	Silty clay loam, silt loam.	CH, CL	A-7	0	100	100	100	95-100	45-60	25-40
	17-59	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-65	20-35
	59-64	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	40-60	25-40
38--------------- Wiota	0-22	Silt loam--------	CL	A-6	0	100	100	100	90-95	30-40	10-20
	22-55	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	15-25
	55-71	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	90-95	40-50	20-30

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
39---------------- Nodaway	0-60	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
41D2-------------- Armster	0-7	Loam--------------	CL	A-6	0	95-100	80-95	75-90	55-80	25-40	11-20
	7-60	Clay loam, clay	CL, CH	A-7	0	95-100	80-95	70-90	55-80	45-60	25-35
48D--------------- Basehor	0-13	Loam, fine sandy loam.	ML, SM, SC, CL	A-4	0-15	80-100	80-100	70-95	40-75	<30	NP-10
	13-15	Weathered bedrock	---	---	---	---	---	---	---	---	---
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
54C2, 54F2-------- Knox	0-8	Silt loam---------	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	90-100	20-35	2-15
	8-47	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	95-100	40-50	20-30
	47-60	Silt loam---------	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	10-25
55D3, 55E3-------- Knox	0-5	Silty clay loam	CL	A-6	0	100	100	95-100	95-100	30-35	10-15
	5-47	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	95-100	40-50	20-30
	47-60	Silt loam---------	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	10-25
61C*:											
Knox-------------	0-8	Silt loam---------	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	90-100	20-35	2-15
	8-36	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	95-100	40-50	20-30
	36-60	Silt loam---------	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	10-25
Urban land.											
61D*:											
Knox-------------	0-5	Silty clay loam	CL	A-6	0	100	100	95-100	95-100	30-35	10-15
	5-47	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	95-100	40-50	20-30
	47-60	Silt loam---------	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	10-25
Urban land.											
72---------------- Dockery	0-8	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-35	5-15
	8-64	Stratified silt loam to silty clay loam.	CL	A-4, A-6	0	100	100	90-100	85-95	25-40	8-20
73---------------- Leta	0-11	Silty clay--------	CL, CH	A-7	0	100	100	95-100	95-100	45-65	30-45
	11-24	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	95-100	90-100	35-65	20-40
	24-60	Stratified silt loam to sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	80-100	51-95	20-35	5-15
74---------------- Levasy	0-29	Silty clay--------	CH, CL	A-7	0	100	100	95-100	85-95	40-60	20-40
	29-60	Very fine sandy loam, silt loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	100	100	70-95	40-75	20-40	4-15
81---------------- Waldron	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	15-25
	8-60	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	100	95-100	90-100	40-65	20-45
82---------------- Parkville	0-16	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	16-60	Stratified very fine sand to silt loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-35	NP-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 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
84----------------- Haynie	0-9	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	9-54	Silt loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	54-60	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	90-100	85-100	40-60	15-35
86----------------- Haynie Variant	0-6	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	6-60	Silt loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	85-100	70-100	25-40	5-15
99----------------- Sarpy	0-3	Fine sandy loam	SM, SM-SC	A-4	0	100	100	70-85	40-50	<25	NP-5
	3-60	Fine sand, loamy fine sand, sand.	SM, SP, SP-SM	A-2-4, A-3	0	100	100	60-80	2-35	---	NP
104*: Udorthents.											
Urban land.											

* 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/cm^3	In/hr	In/in	pH					Pct
1B, 1C----------- Sibley	0-16	20-30	1.20-1.50	0.6-2.0	0.19-0.21	5.6-7.8	Moderate-----	0.28	5	6	3-4
	16-47	28-38	1.30-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28			
	47-65	20-30	1.20-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.43			
2C2-------------- Higginsville	0-8	20-27	1.30-1.50	0.6-2.0	0.21-0.24	5.6-7.3	Low----------	0.37	5	6	3-4
	8-13	27-35	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
	13-42	27-35	1.40-1.50	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
	42-60	25-30	1.50-1.60	0.6-2.0	0.18-0.22	5.1-6.5	Moderate-----	0.37			
6B--------------- Sharpsburg	0-13	25-27	1.30-1.35	0.6-2.0	0.21-0.23	5.1-6.5	Moderate-----	0.32	5	6	3-4
	13-26	36-42	1.35-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	26-55	30-38	1.40-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	55-60	25-32	1.40-1.45	0.6-2.0	0.18-0.20	6.1-6.5	Moderate-----	0.43			
6C2, 6D2--------- Sharpsburg	0-7	25-27	1.30-1.35	0.6-2.0	0.21-0.23	5.1-6.5	Moderate-----	0.32	5	6	3-4
	7-26	36-42	1.35-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	26-54	30-38	1.40-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	54-60	25-32	1.40-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.43			
8*. Pits											
10D*, 10F*: Snead-----------	0-11	20-40	1.30-1.40	0.2-0.6	0.12-0.16	6.1-7.3	Moderate-----	0.28	3	6	2-4
	11-19	40-60	1.25-1.35	0.06-0.2	0.07-0.11	6.6-8.4	High---------	0.24			
	19-25	40-60	1.25-1.35	0.06-0.2	0.12-0.14	6.6-8.4	High---------	0.32			
	25-60	---	---	---	---	---	-------------	----			
Rock outcrop.											
26B, 26C2, 26D2-- Ladoga	0-9	18-35	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6	2-3
	9-40	36-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	40-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
30--------------- Kennebec	0-35	22-30	1.25-1.35	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.32	5	6	5-6
	35-60	24-28	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.43			
31--------------- Colo	0-6	20-26	1.25-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.28	5	6	3-5
	6-45	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	High---------	0.28			
	45-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.3	High---------	0.28			
36--------------- Bremer	0-17	25-32	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7	5-7
	17-59	35-42	1.30-1.40	0.2-0.6	0.15-0.17	5.6-6.5	High---------	0.28			
	59-64	32-38	1.40-1.45	0.2-0.6	0.18-0.20	5.6-6.5	High---------	0.28			
38--------------- Wiota	0-22	24-32	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	6	3-4
	22-55	30-36	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	55-71	28-34	1.40-1.45	0.6-2.0	0.18-0.20	6.1-6.5	Moderate-----	0.43			
39--------------- Nodaway	0-60	18-28	1.25-1.35	0.6-2.0	0.20-0.23	5.6-7.3	Moderate-----	0.37	5	6	2-3
41D2------------- Armster	0-7	15-27	1.35-1.50	0.6-2.0	0.17-0.20	4.5-7.3	Moderate-----	0.37	5	6	1-2
	7-60	35-48	1.35-1.45	0.2-0.6	0.10-0.18	4.5-7.3	High---------	0.37			
48D-------------- Basehor	0-13	8-22	1.30-1.45	2.0-6.0	0.17-0.21	5.1-6.5	Low----------	0.32	2	3	---
	13-15	---	---	---	---	---	-------------	----			
	15	---	---	---	---	---	-------------	----			
54C2, 54F2------- 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
	8-47	25-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
	47-60	18-27	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.43			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
55D3, 55E3------- Knox	0-5	27-30	1.20-1.30	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.32	5	6	1-3
	5-47	25-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
	47-60	18-27	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.43			
61C*:											
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
	8-36	25-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
	36-60	18-27	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.43			
Urban land.											
61D*:											
Knox------------	0-5	27-30	1.20-1.30	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.32	5	6	1-3
	5-47	25-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
	47-60	18-27	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.43			
Urban land.											
72--------------- Dockery	0-8	15-27	1.35-1.45	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.37	5	6	2-4
	8-64	18-30	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Moderate-----	0.37			
73--------------- Leta	0-11	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
	11-24	35-48	1.30-1.50	0.06-0.2	0.11-0.19	7.4-7.8	High---------	0.28			
	24-60	10-27	1.30-1.50	0.6-2.0	0.14-0.22	7.4-8.4	Low----------	0.28			
74--------------- Levasy	0-29	35-60	1.25-1.40	0.06-0.2	0.12-0.20	7.4-8.4	High---------	0.28	5	8	2-4
	29-60	12-27	1.35-1.50	0.6-2.0	0.10-0.18	7.4-8.4	Low----------	0.43			
81--------------- Waldron	0-8	30-35	1.35-1.50	0.2-0.6	0.21-0.23	6.6-7.8	Moderate-----	0.32	5	7	2-4
	8-60	35-50	1.45-1.60	0.06-0.2	0.10-0.18	7.4-8.4	High---------	0.32			
82--------------- Parkville	0-16	35-40	1.30-1.50	0.06-0.2	0.12-0.21	6.6-8.4	Moderate-----	0.28	5	4	1-3
	16-60	4-25	1.40-1.60	0.6-2.0	0.18-0.22	7.4-8.4	Low----------	0.28			
84--------------- Haynie	0-9	15-25	1.35-1.40	0.6-2.0	0.18-0.20	6.6-8.4	Low----------	0.37	5	4L	1-3
	9-54	10-18	1.35-1.40	0.6-2.0	0.16-0.19	7.4-8.4	Low----------	0.37			
	54-60	35-60	1.20-1.30	<0.2	0.08-0.12	7.4-8.4	High---------	0.37			
86--------------- Haynie Variant	0-6	15-25	1.25-1.40	0.6-2.0	0.18-0.20	6.6-8.4	Low----------	0.37	5	4L	1-3
	6-60	10-18	1.35-1.40	0.6-2.0	0.16-0.19	7.4-8.4	Low----------	0.37			
99--------------- Sarpy	0-3	5-10	1.20-1.40	2.0-6.0	0.09-0.13	6.6-8.4	Low----------	0.20	5	3	<1
	3-60	2-5	1.20-1.50	>6.0	0.05-0.09	6.6-8.4	Low----------	0.15			
104*:											
Udorthents.											
Urban land.											

* 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 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			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1B, 1C------------ Sibley	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.
2C2--------------- Higginsville	C	None---------	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	High-----	Moderate	Moderate.
6B, 6C2, 6D2------ Sharpsburg	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
8*. Pits												
10D*, 10F*:												
Snead------------	D	None---------	---	---	2.0-3.0	Perched	Nov-Mar	20-40	Soft	Moderate	High-----	Low.
Rock outcrop.												
26B, 26C2, 26D2--- Ladoga	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
30---------------- Kennebec	B	Frequent----	Brief-----	Nov-Jun	3.0-5.0	Apparent	Nov-Jul	>60	---	High-----	Moderate	Low.
31---------------- Colo	B/D	Frequent----	Very brief to long.	Nov-Jun	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
36---------------- Bremer	C	Occasional	Very brief	Nov-Jun	1.0-2.0	Apparent	Nov-Jul	>60	---	High-----	Moderate	Moderate.
38---------------- Wiota	B	Rare---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
39---------------- Nodaway	B	Frequent----	Very brief to brief.	Nov-Jun	3.0-5.0	Apparent	Apr-Jul	>60	---	High-----	Moderate	Low.
41D2-------------- Armster	C	None---------	---	---	3.0-5.0	Apparent	Nov-Mar	>60	---	Moderate	High-----	Moderate.
48D--------------- Basehor	D	None---------	---	---	>6.0	---	---	11-20	Hard	Moderate	Low------	Moderate.
54C2, 54F2, 55D3, 55E3------------- Knox	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Low.
61C*, 61D*:												
Knox-------------	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Low.
Urban land.												

See footnotes 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				
72----------------- Dockery	C	Frequent----	Brief-----	Nov-Jun	2.0-3.0	Apparent	Nov-Apr	>60	---	High-----	Moderate	Low.
73----------------- Leta	C	Occasional	Brief-----	Nov-Jun	1.0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
74**--------------- Levasy	C	Occasional	Long------	Nov-Jun	+1-1.5	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
81----------------- Waldron	D	Occasional	Brief-----	Nov-Jun	1.0-3.0	Perched	Nov-May	>60	---	High-----	High-----	Low.
82----------------- Parkville	C	Occasional	Brief-----	Nov-Jun	1.0-2.0	Apparent	Nov-Apr	>60	---	Moderate	High-----	Low.
84----------------- Haynie	B	Occasional	Very brief	Nov-Jun	4.0-6.0	Perched	Oct-Jun	>60	---	High-----	Low------	Low.
86----------------- Haynie Variant	B	Occasional	Very brief	Nov-Jun	2.0-3.0	Apparent	Nov-May	>60	---	High-----	Low------	High.
99----------------- Sarpy	A	Occasional	Brief to long.	Nov-Jun	>6.0	---	---	>60	---	Low------	Low------	Low.
104*: Udorthents.												
Urban land.												

* See description of the map unit for composition and behavior characteristics of the map unit.

** In the "High water table--Depth" column, a plus sign preceeding the range in depth indicates that the water table is above the surface of the soil. The first numeral indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Armster	Fine, montmorillonitic, mesic Mollic Hapludalfs
Basehor	Loamy, siliceous, mesic Lithic Dystrochrepts
Bremer	Fine, montmorillonitic, mesic Typic Argiaquolls
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Dockery	Fine-silty, mixed, nonacid, mesic Aquic Udifluvents
Haynie	Coarse-silty, mixed (calcareous), mesic Mollic Udifluvents
Haynie Variant	Coarse-silty, mixed (calcareous), mesic Aquic Udifluvents
Higginsville	Fine-silty, mixed, mesic Aquic Argiudolls
Kennebec	Fine-silty, mixed, mesic Cumulic Hapludolls
Knox	Fine-silty, mixed, mesic Mollic Hapludalfs
Ladoga	Fine, montmorillonitic, mesic Mollic Hapludalfs
Leta	Clayey over loamy, montmorillonitic, mesic Fluvaquentic Hapludolls
Levasy	Clayey over loamy, montmorillonitic (calcareous), mesic Fluvaquentic Haplaquolls
Nodaway	Fine-silty, mixed, nonacid, mesic Mollic Udifluvents
Parkville	Clayey over loamy, montmorillonitic, mesic Fluvaquentic Hapludolls
Sarpy	Mixed, mesic Typic Udipsamments
Sharpsburg	Fine, montmorillonitic, mesic Typic Argiudolls
Sibley	Fine-silty, mixed, mesic Typic Argiudolls
Snead	Fine, mixed, mesic Aquic Hapludolls
Udorthents	Fine-silty, mixed, mesic Typic Udorthents
Waldron	Fine, montmorillonitic (calcareous), mesic Aeric Fluvaquents
Wiota	Fine-silty, mixed, mesic Typic Argiudolls

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Persons with Disabilities

If you are deaf, are hard of hearing, or have speech disabilities and you wish to file either an EEO or program complaint, please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

If you have other disabilities and wish to file a program complaint, please see the contact information above. If you require alternative means of communication for program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (http://directives.sc.egov.usda.gov/33085.wba).

All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (http://directives.sc.egov.usda.gov/33086.wba).