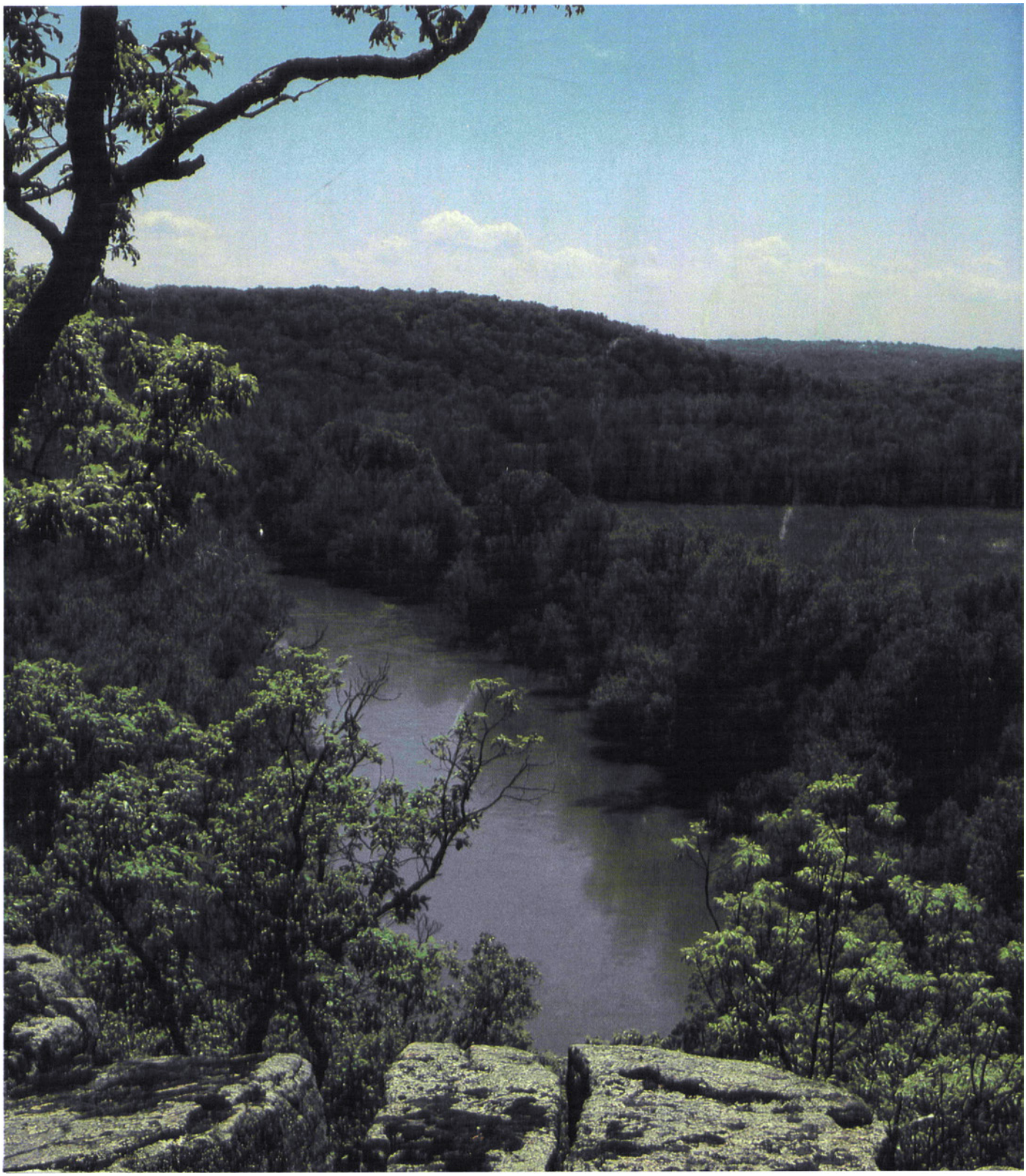
United States Department of Agriculture

Soil Conservation Service

In cooperation with Missouri Agricultural Experiment Station

Soil Survey of Franklin County, Missouri



How To Use This Soil Survey

General Soil Map

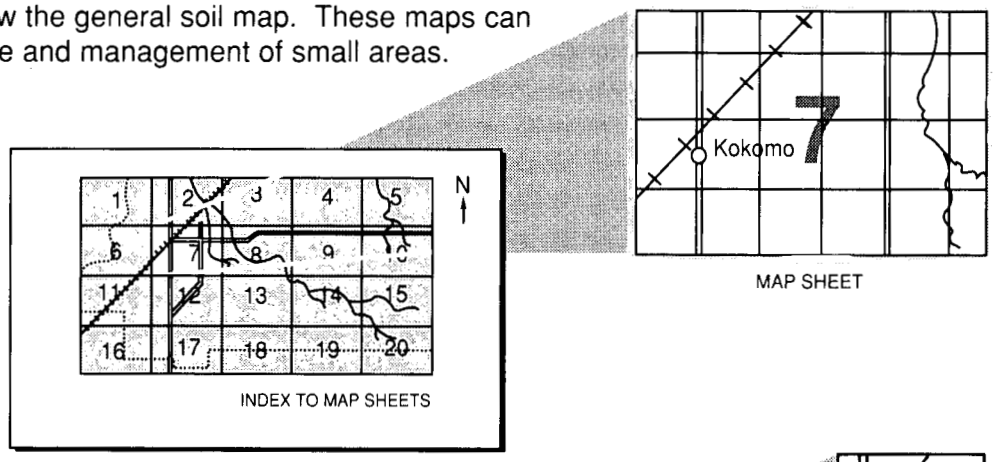
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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

Detailed Soil Maps

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

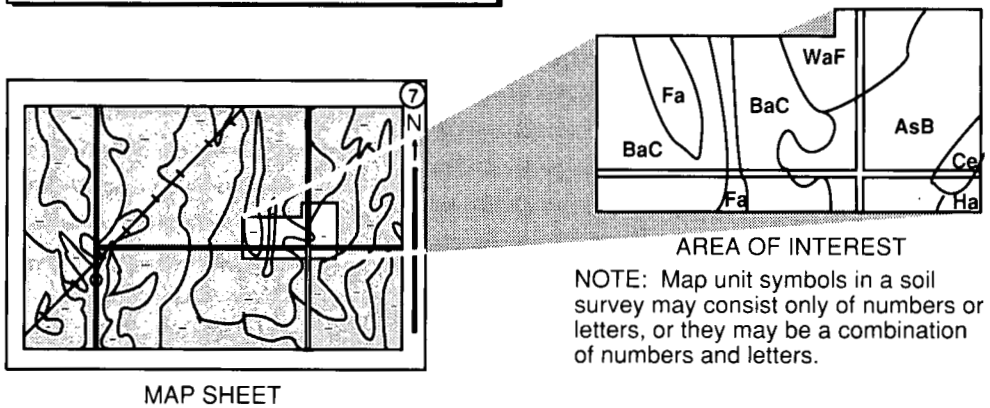
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

MAP SHEET

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



MAP SHEET

AREA OF INTEREST

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

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

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

Major fieldwork for this soil survey was completed in 1985. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This survey was made cooperatively by the Soil Conservation Service and the Missouri Agricultural Experiment Station. The Missouri Department of Natural Resources provided a soil scientist to assist with the fieldwork. The survey is part of the technical assistance furnished to the Franklin County Soil and Water Conservation District.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: The Meramec River flowing through an area of the Haymond-Pope association. The forested area in the background is in the Goss-Hobson association.

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Issued April 1989

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Summary of Tables

Foreword

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

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

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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described, and information on specific uses is given. 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 Franklin County, Missouri

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Fieldwork by Robert J. Held and Susan M. Essner, Soil Conservation Service; F. Michael Struckhoff, Missouri Department of Natural Resources; and John T. Todd and Gregory W. Lough, Franklin County Soil and Water Conservation District

Significant contributions made by Paul B. Freese, Franklin Soil and Water Conservation District; Mary D. Allison, Soil Conservation Service; and Wolfgang A. Scheucher and Chris Noble, Missouri Department of Natural Resources

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

FRANKLIN COUNTY is in the east-central part of Missouri (fig. 1), on the northern edge of the Ozark region. It has an area of 595,226 acres, or about 930 square miles, including 5,203 acres of water areas 40 acres or more in size.

Franklin County is bordered on the north by the Missouri River and St. Charles County, on the east by St. Louis and Jefferson Counties, on the south by Washington and Crawford Counties, and on the west by Gasconade County. Union, near the center of the county, is the county seat. The historic Missouri River town of Washington is the largest town. In 1980, it had a population of about 9,300. In the same year, the population of the county was 71,200.

The county is in three land resource areas within the East and Central Farming and Forest Region *(15)*. The northern part of the county is on the Central Mississippi Valley Wooded Slopes, the central part is on the Ozark Border, and the southern part is on the Ozark Highland.

This survey updates the soil survey of Franklin County published in 1913 *(16)*. It defines the soil boundaries more clearly and provides more detailed information about the soils.

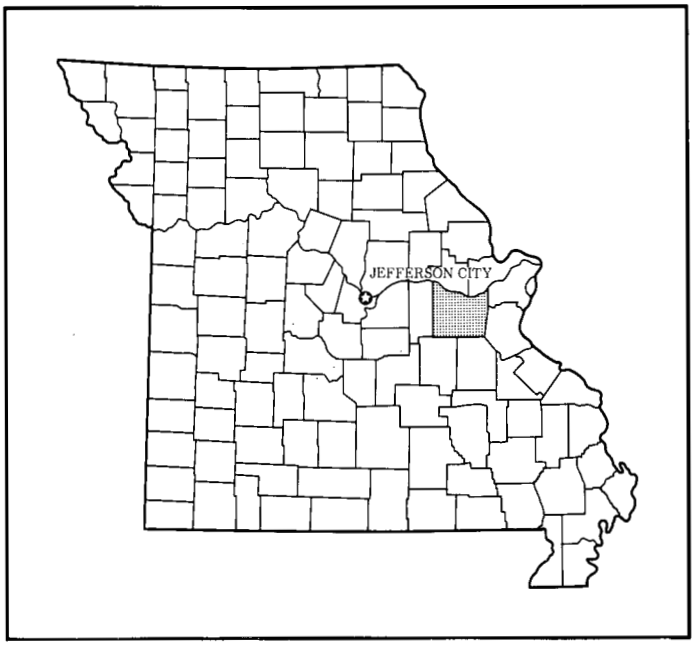

Figure 1.—Location of Franklin County in Missouri.

General Nature of the County

This section gives general information about the county. It describes climate; physiography, relief, and drainage; and history and development.

Climate

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

The consistent pattern of climate in Franklin County is one of 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. The annual rainfall is normally adequate for corn, soybeans, and small grain.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Union in the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter the average temperature is 33 degrees F, and the average daily minimum temperature is 23 degrees. The lowest temperature on record, which occurred at Union on January 17, 1977, is -26 degrees. In summer the average temperature is 76 degrees, and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred at Union on July 14, 1954, is 118 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 nearly 37 inches. Of this, about 22.6 inches, or more than 60 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 16 inches. The heaviest 1-day rainfall during the period of record was 7.56 inches at Union on June 15, 1957. Thunderstorms occur on about 45 days each year. Tornadoes and severe thunderstorms strike occasionally. Hailstorms sometimes occur in small areas during the warmer part of the year.

The average seasonal snowfall is 20 inches. The greatest snow depth at any one time during the period of record was 36 inches. On the average, 14 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 85 percent. The sun shines 65 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 12 miles per hour, in spring.

Physiography, Relief, and Drainage

The physiographic features of Franklin County occur as four major landforms and a number of geologic formations. Geologic erosion, differential weathering of different kinds of rock, and stream drainage patterns have contributed to the morphology of the landforms and of other surface features. The major landforms are the Salem Plateau, the River Hills, the St. Louis highlands, and the flood plains along the Missouri River and along other streams.

The Salem Plateau is by far the most extensive landform in the county. It is a high area that is dissected by many streams and hollows and that is tilted toward the north and east. The elevation drops gradually in those directions. The most extensively dissected areas of this plateau are in the southern part of the county, along the flanks of the Ozark dome, where the Ozark uplift has elevated older rocks to positions above those of younger age. Cherty red clays and some cherty dolomite bedrock are exposed on these steep side slopes. Goss and Bardley soils formed on these slopes. Union and Hobson soils, which have a fragipan, are on the more stable ridgetops.

Lily, Holstein, and Ramsey soils formed in areas where sandstone has been exposed by dissection of this plateau or by a random pattern of anticlines. Bucklick, Gasconade, and Gatewood soils are in areas where relatively chert free dolomite overlies the sandstone.

The Salem Plateau is bounded on the northeast by the Crystal escarpment, which separates the plateau from a small area of highlands extending from St. Louis County. This area is characterized by narrow, loess-capped ridgetops and steep side slopes. Winfield soils are on the ridgetops, and Gasconade and Menfro are the dominant soils on the side slopes.

The River Hills consist of loess-covered uplands in a band 1 to 3 miles wide. They are bounded on the north by the flood plains along the Missouri River. The southern boundary of these hills is much less distinct than the northern one because the thickness of the

loess gradually decreases with distance from the river. The loess is thickest on north- and east-facing slopes. Menfro soils are the dominant soils on these slopes. The hills are dissected by creeks and small streams draining into the Missouri River.

The major flood plains in the county are along the Missouri, Meramec, and Bourbeuse Rivers and along their tributaries. Loamy, silty, and clayey alluvium was deposited on the flood plains along the Missouri River. Blake, Haynie, Waldron, Booker, and Hodge soils formed in this material. On the flood plains along the smaller streams, gravelly basal deposits underlie loamy and silty deposits. Midco, Cedargap, and Haymond soils formed in this material.

About 60 percent of the county is drained eastward into the Mississippi River through the Meramec and Bourbeuse Rivers and their tributaries. This area is south of a major divide that spans the county from west to northeast. The areas north of this divide are drained into the Missouri River, mainly by way of Boeuf, Berger, St. John's, and Dubois Creeks.

Elevation ranges from 440 feet above sea level where the Meramec River leaves the county to 1,050 feet in an area directly west of Sullivan.

History and Development

The early inhabitants of what is now Franklin County were Indians whose tribal names are lost in antiquity. Flint projectile points, ground stone axes, and fired clay potsherds mark their tenure, and a few ancient burial mounds overlook the rivers from the tops of bluffs. Shawnee, Delaware, and Osage Indians also inhabited the survey area at one time.

The survey area became part of the United States in 1803, the year of the Louisiana Purchase. Prior to this date, it was under French rule, which followed a long period of Spanish dominion. The imprint of Spanish rule remains in the vicinity of Washington and Labadie, where many of the present-day property boundaries follow those of the original Spanish land grants.

The first American settler was probably Kincaid Caldwell, who built his home near the present site of Washington in 1803 *(4)*. In the following years, settlers from Kentucky, Tennessee, and Virginia made their way to the survey area. A population of 1,928 was reported in 1823.

Franklin County was established in 1818, when it was separated from St. Louis County. A settlement was established at St. Albans during the same year, but it was washed away when the Missouri River flooded in 1844. In 1826, the county seat was moved from the village of Newport, which was along the Missouri River, to Union. The present county boundaries date from the separation of Gasconade County in 1845. Washington, now the largest town in the county, was founded in 1836.

Mining played an important part in the early development of Franklin County, especially in the southern part. Iron, lead, and copper were mined in substantial quantities in the 1800's *(4)*. Iron ore was processed at the Moselle Iron Furnace from 1850 to 1874. During this period, copper was manufactured at the Stanton Copper Works *(4)* and was hauled to St. Louis. The county had a number of lead mines, the largest of which was the Virginia Mines near St. Clair. Of lesser importance were coal, which was mined in small quantities near the Gasconade County line, and barite "tiff," which was hand dug from shallow pits in the southern part of the county.

Early German settlers obtained building stone for houses, churches, and outbuildings from many small quarries in areas of Jefferson City dolomite, a formation still quarried for road-building and construction material. An exposure of St. Peters sandstone at Pacific is still quarried for silica sand. Also continuing to the present is the occasional excavation of refractory clay deposits.

Most of the early settlers came in search of productive soils to farm. They were especially attracted to soils supporting vigorous tree stands. Removal of the timber by girdling or by cutting and burning and the battle to control sprouts after the trees were removed consumed much of the time and energy of the early settlers. Logs were used to build houses, barns, and sheds or were split into rails. The small fields that gradually emerged from the wilderness were planted to corn, wheat, clover, tobacco, or garden vegetables. Livestock of all kinds were turned out into open areas to graze. Farming became most intensive on the Menfro, Crider, and Bucklick soils in the northern part of the county and on the better drained soils on bottom land, such as Haynie and Haymond soils.

In 1910, wheat was by far the most important crop. It was grown on about 66,000 acres. Wheat yields ranged from 10 to 30 bushels per acre and averaged about 14 bushels. Most of the wheat was ground into flour by local mills. Yields of corn ranged from 15 to 75 bushels per acre and averaged 39 bushels. Other crops included oats, sorghum, popcorn, broomcorn, flax, rye, buckwheat, and tobacco. Cowpeas were grown for hay and forage. The most common crop rotation included corn, wheat, and clover *(16)*. This cropping sequence is still widely used in the county.

Manufacturing and service industries currently are the main economic enterprises in the county, but farming and agribusiness have a very important role. About 55 percent of the county is cleared and is used for pasture, hay, or cultivated crops, and 45 percent is forested. A substantial acreage that was cleared in the past is now reverting to forest. Corn, soybeans, wheat, and grain sorghum are the principal cultivated crops. Beef cattle are pastured on thousands of acres. The county has several large dairy herds. Hog raising is important on many farms.

How This Survey Was Made

This survey was made to provide information about the soils in Franklin County. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management 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, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of soil-landscape relationships, 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 kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

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

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

General Soil Map Units

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

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

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

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

Soil Descriptions

1. Union-Beemont Association

Very deep and deep, gently sloping to moderately steep, moderately well drained, silty and cherty soils; on uplands

This association is on the major upland divides of the Owensville and Salem plateaus, which extend into the county from the west and south. It makes up about 22 percent of the county. It is about 66 percent Union and similar soils, 19 percent Beemont soils, and 15 percent minor soils (fig. 2).

The very deep, gently sloping to strongly sloping Union soils are on ridgetops and the convex, mainly north-facing, upper side slopes. Typically, the surface layer is brown silt loam. The upper part of the subsoil is yellowish brown silty clay loam, strong brown and dark brown silty clay, and dark brown silty clay loam. The next part is a dense and brittle fragipan of dark yellowish brown silt loam and brown very cherty silt loam. The lower part is yellowish brown clay.

The deep, strongly sloping and moderately steep Beemont soils are on the upper side slopes and around the head of drainageways. Typically, the surface layer is very dark grayish brown cherty silt loam. The subsurface layer is yellowish brown and light yellowish brown cherty and very cherty silt loam. The subsoil is yellowish red and yellowish brown clay in the upper part and mottled dark yellowish brown and grayish brown cherty silty clay in the lower part. Hard sandstone bedrock is at a depth of about 52 inches.

Of minor extent in this association are the somewhat poorly drained Hartville soils on foot slopes and low terraces and the well drained Pope and Gladden soils on small flood plains along streams.

About half of the acreage in this association has been cleared of trees and is used for pasture, hay, or cultivated crops. Small grain and grain sorghum are the major crops. Livestock production is the main enterprise. The uncleared areas, which include nearly all areas of the Beemont soils, are both small and large tracts of mixed native hardwoods.

The hazard of erosion and insufficient summer rainfall are the main concerns in managing the Union soils for cultivated crops. Overgrazing and insufficient soil moisture during summer months are the main concerns in managing pasture.

This association provides habitat for woodland wildlife, notably deer, turkeys, and squirrels. It also provides habitat for openland wildlife, such as rabbits and quail.

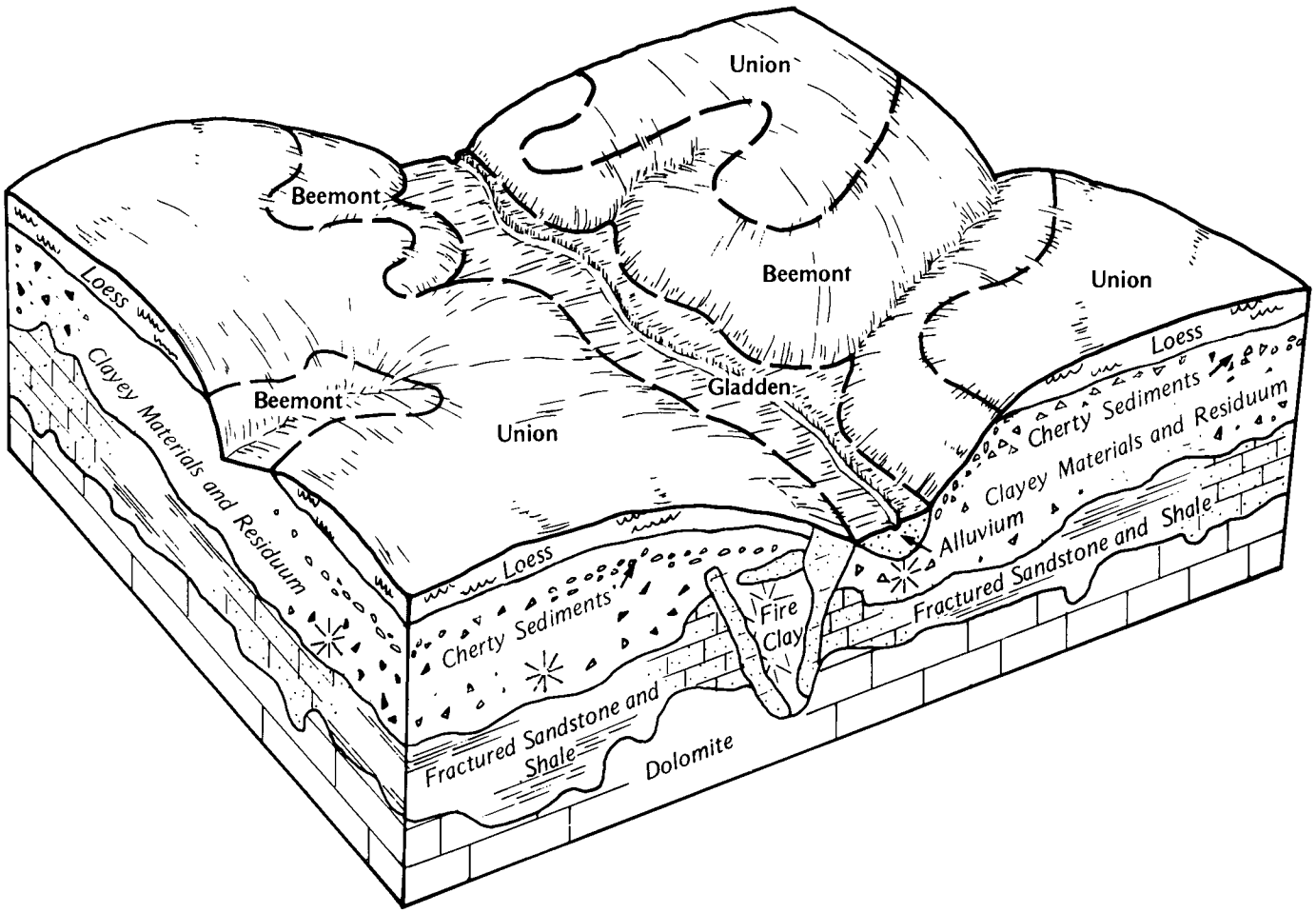

Figure 2.—Pattern of soils and parent material in the Union-Beemont association.

Most of the sites for buildings and sanitary facilities in this association are in areas of the Union soils. The main limitations affecting these uses are the shrink-swell potential, slope, slow or very slow permeability, and wetness.

2. Bucklick-Gatewood-Gasconade Association

Deep to shallow, gently sloping to steep, moderately well drained to somewhat excessively drained, silty, cherty, and flaggy soils; on uplands

This association is on the more dissected parts of areas where the soils are underlain by nearly chert free dolomite bedrock. It makes up about 18 percent of the county. It is about 35 percent Bucklick soils, 21 percent Gatewood soils, 15 percent Gasconade soils, and 29 percent minor soils (fig. 3).

The deep, well drained, gently sloping to steep Bucklick soils are on narrow ridgetops and on side slopes. Typically, the surface layer is dark yellowish brown silt loam. The subsoil is yellowish red silty clay loam and silty clay in the upper part; yellowish red, mottled silty clay in the next part; and yellowish red, mottled very cherty silty clay and brown silty clay in the lower part. Hard dolomite bedrock is at a depth of about 50 inches.

The moderately deep, moderately well drained, moderately steep and steep Gatewood soils are mainly on south-facing side slopes. Typically, the surface layer and subsurface layer are brown cherty silt loam, and the subsoil is dark brown, firm clay. The substratum is dark yellowish brown, firm clay. Hard dolomite bedrock is at a depth of about 29 inches.

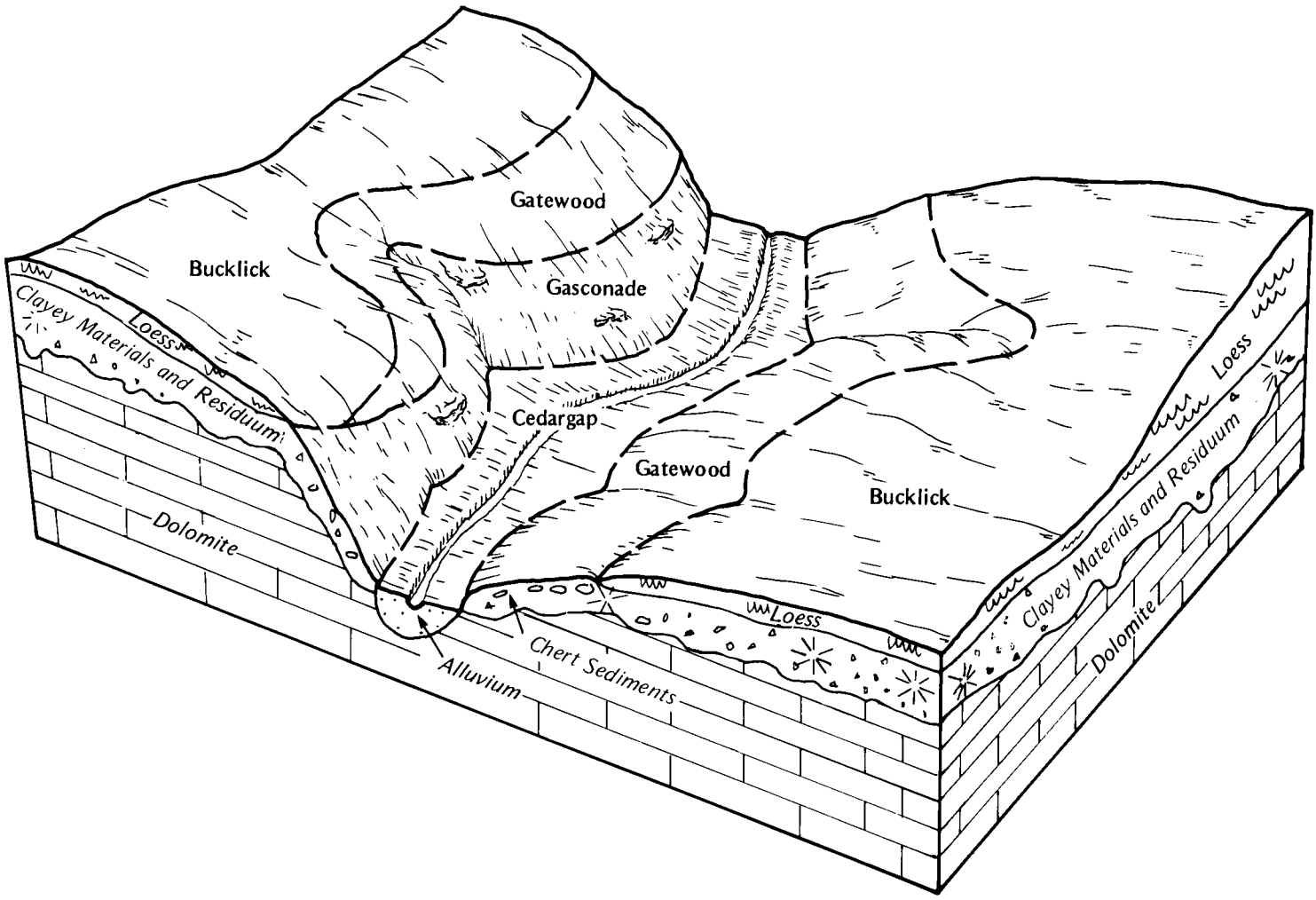

Figure 3.—Pattern of soils and parent material in the Bucklick-Gatewood-Gasconade association.

The shallow, somewhat excessively drained, strongly sloping to steep Gasconade soils commonly are on the ends of ridges and on south-facing side slopes. Typically, the surface layer is very dark gray flaggy silty clay loam, and the subsoil is very dark brown very flaggy silty clay. Hard dolomite bedrock is at a depth of about 15 inches.

Of minor extent in this association are the somewhat poorly drained Hartville soils on stream terraces and the cherty Cedargap and loamy Gladden soils on narrow flood plains.

About 60 percent of this association is forested. The forested acreage includes nearly all areas of the Gatewood and Gasconade soils and the steeper, more dissected areas of the Bucklick soils. The Gatewood and Gasconade soils seldom produce timber of marketable quality, but some good-quality white oak and other hardwoods are harvested from the Bucklick soils on north-facing slopes. The erosion hazard and the equipment limitation are management concerns in the steeper areas of all three soils.

A substantial acreage of the Bucklick soils has been cleared of trees but has reverted to redcedar and other second-growth trees. Many such tracts, especially in the eastern part of the county, are in residential or recreational areas.

The cleared areas of this association occur mainly as the less sloping Bucklick soils. They are used for pasture, hay, or cultivated crops. Livestock production is an important enterprise. In recent years, the acreage

used for pasture or hay has greatly increased and the acreage used for row crops has decreased. A significant acreage, however, is used for small grain and row crops. Some alfalfa is grown for hay. The main management needs in cultivated areas are measures that control erosion and maintain fertility. The main management needs in pastured areas are measures that control grazing and brush and that keep the pasture in good condition.

This association provides nearly ideal conditions for the development of habitat for wildlife, especially woodland wildlife.

The Bucklick soils are the best sites in this association for buildings and sanitary facilities. They are limited as sites for these uses mainly by the shrink-swell potential and the slope. The Gatewood and Gasconade soils generally are not used for building site development because of the slope and the depth to bedrock.

3. Crider-Bucklick Association

Very deep and deep, gently sloping to steep, well drained, silty soils; on uplands

This association extends across the northern part of the county. It is on the edge of the Ozark uplift and is dissected by streams draining the Ozark highlands. It makes up about 15 percent of the county. It is about 50 percent Crider soils, 32 percent Bucklick soils, and 18 percent minor soils (fig. 4).

The very deep, gently sloping to moderately steep Crider soils are on ridgetops, side slopes, and high stream terraces. Typically, the surface layer is dark yellowish brown silt loam, and the subsoil is dark brown, yellowish red, and reddish brown silty clay loam.

The deep, gently sloping to steep Bucklick soils are on ridgetops and south-facing side slopes. Typically, the surface layer is dark yellowish brown silt loam. The subsoil is yellowish red silty clay loam and silty clay in the upper part; yellowish red, mottled silty clay in the next part; and yellowish red, mottled very cherty silty clay and brown silty clay in the lower part. Hard dolomite bedrock is at a depth of about 50 inches.

Of minor extent in this association are the moderately deep Gatewood and shallow Gasconade soils on uplands, the somewhat poorly drained Hartville soils on foot slopes and low stream terraces, and the nearly level Haymond soils on narrow flood plains.

About 65 percent of this association has been cleared of trees and is used for pasture, hay, or cultivated crops. Wheat is the principal small grain, and corn, soybeans, and grain sorghum are the chief row crops. A substantial acreage of alfalfa is grown for hay. Livestock production is a major enterprise. A large acreage is pastured. Farm ponds furnish most of the livestock water. The main management needs in cultivated areas are measures that control erosion and maintain fertility. The main management needs in pastured areas are measures that control grazing and brush and that keep the pasture in good condition.

Most of the timber in areas of this association is on the steeper, more dissected parts of the landscape. Scattered areas of oak, hickory, and other mixed hardwoods are throughout the association, mainly in small, unmanaged woodlots. Many of the woodlots are pastured along with the adjacent pastured areas. Some previously cleared areas are severely eroded and have reverted to redcedar and other second-growth trees. The erosion hazard and the equipment limitation are management concerns in the steeper areas.

The wooded areas enhance the diversity of wildlife habitat in this association. The association provides nearly ideal conditions for the development of habitat for both woodland and openland wildlife.

The major soils in this association are suited to building site development and sanitary facilities. The main limitations affecting these uses are the shrink-swell potential and depth to bedrock in the Bucklick soils.

4. Goss-Hobson Association

Very deep, moderately sloping to very steep, well drained and moderately well drained, cherty and loamy soils; on uplands

This association is on uplands highly dissected by narrow drainageways. It is in areas where the oldest rock formations in the county have been exposed to weathering and stream dissection along the flanks of the Ozark uplift. Nearly all areas are drained by the Meramec and Bourbeuse Rivers.

This association makes up about 13 percent of the county. It is about 60 percent Goss soils, 20 percent Hobson soils, and 20 percent minor soils (fig. 5).

The well drained, strongly sloping to very steep Goss soils are on narrow ridgetops and on side slopes. Typically, the surface layer is very dark grayish brown cherty silt loam. The subsurface layer is pale brown and yellowish brown cherty and very cherty silt loam. The subsoil is red very cherty clay.

The moderately well drained, moderately sloping and strongly sloping Hobson soils are on narrow ridgetops.

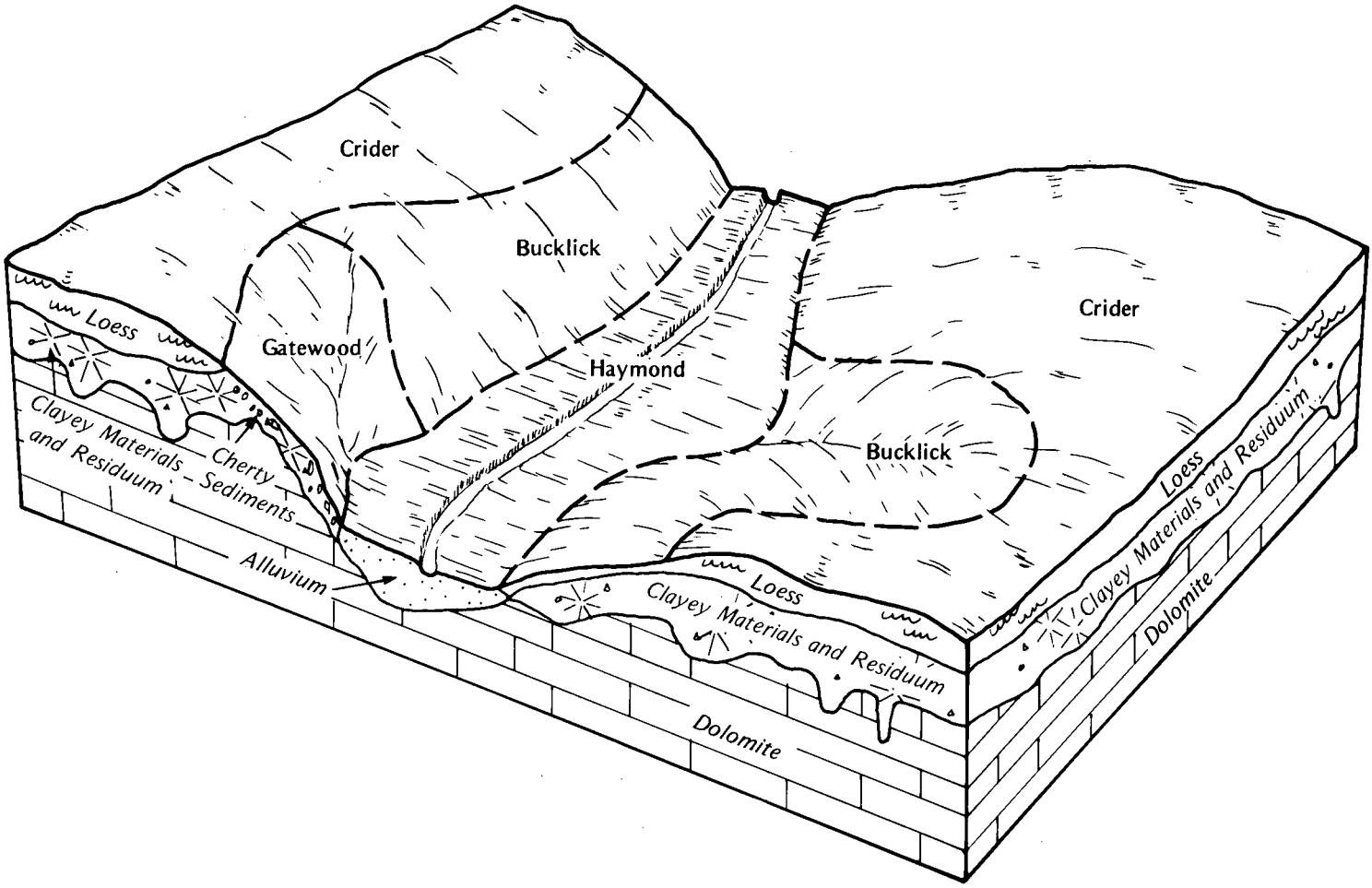

Figure 4.—Pattern of soils and parent material in the Crider-Bucklick association.

Typically, the surface layer is dark brown loam. The subsurface layer is brown loam. The upper part of the subsoil is dark brown and strong brown clay loam. The lower part is a dense and brittle fragipan of brown and yellowish brown loam.

Of minor extent in this association are the Bardley, Union, Lily, Ramsey, Gladden, and Midco soils. The moderately deep Bardley soils are on the lower side slopes. Union soils have more chert and less sand than the Hobson soils. They are on narrow ridgetops. The moderately deep Lily and shallow Ramsey soils are on the upper side slopes. The well drained Gladden and somewhat excessively drained Midco soils are on narrow flood plains.

More than 80 percent of this association is forested, dominantly with white oak, and is used for timber, wildlife habitat, or recreational purposes. The cleared areas, which are mainly on foot slopes, narrow bottom land, and ridgetops, are used for pasture or hay or for wildlife habitat. Only a small acreage, mainly along the larger creeks, is used for cultivated crops.

In most of the timbered areas, stand improvement and selective cutting are needed. The erosion hazard and the equipment limitation are management concerns on the steeper slopes, and seedling mortality and windthrow are problems on the Hobson soils.

This association provides habitat for woodland wildlife, notably deer, wild turkey, and squirrels. Mast production varies widely from year to year.

Most of the urban development in areas of this association are on the Hobson soils. These soils are limited as sites for buildings and sanitary facilities mainly by wetness, slope, and slow permeability. The slope and the content of stones are the main problems

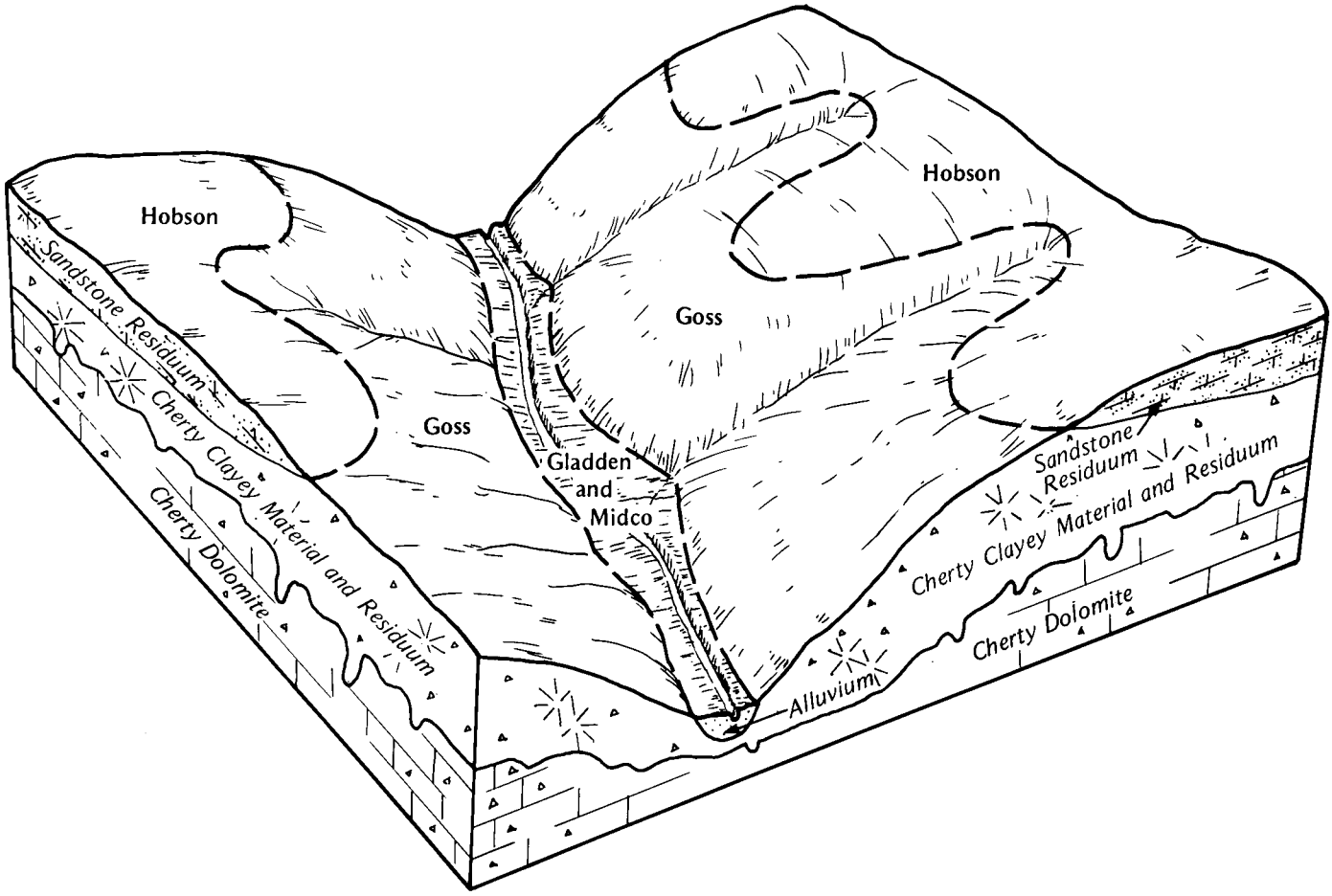

Figure 5.—Pattern of soils and parent material in the Goss-Hobson association.

affecting building site development and onsite waste disposal on the Goss soils.

5. Hobson-Lily-Ramsey Association

Very deep, moderately deep, and shallow, moderately sloping to steep, moderately well drained to somewhat excessively drained, loamy soils; on uplands

This association consists mainly of moderately sloping soils on ridgetops and strongly sloping to steep soils on highly dissected side slopes. The soils formed in loamy sandstone residuum.

This association makes up about 12 percent of the county. It is about 42 percent Hobson and similar soils, 25 percent Lily soils, 11 percent Ramsey soils, and 22 percent minor soils.

The very deep, moderately well drained, moderately sloping and strongly sloping Hobson soils are on narrow ridgetops and the upper side slopes. Typically, the surface layer is dark brown loam. The subsurface layer is brown loam. The upper part of the subsoil is dark brown and strong brown clay loam. The lower part is a dense and brittle fragipan of brown and yellowish brown loam.

The moderately deep, well drained, strongly sloping to steep Lily soils are on side slopes. Typically, the surface layer is dark grayish brown loam. The subsurface layer is brown loam. The subsoil is brown loam and yellowish red sandy clay loam. Hard sandstone bedrock is at a depth of about 29 inches.

The shallow, somewhat excessively drained, strongly sloping to steep Ramsey soils are on side slopes along drainageways and on shoulder slopes. Typically, the

surface layer is very dark grayish brown loam. The subsurface layer is brown loam. The subsoil is yellowish brown loam and brown sandy loam. Hard sandstone bedrock is at a depth of about 16 inches.

Of minor extent in this association are the Holstein soils on the lower side slopes and the Pope and Gladden soils on small flood plains along streams. All of the minor soils are very deep and do not have a fragipan.

About 50 percent of this association, including most areas of the Hobson soils, has been cleared of trees and is used for pasture or hay. A limited acreage is used for cultivated crops, mainly grain sorghum and wheat. The main management concerns in cultivated areas are erosion and droughtiness. The main management needs in pastured areas are measures that control grazing and brush and that keep the pasture in good condition.

Forested areas have stands of trees that vary greatly in quality. Many areas have stands of scrubby hardwoods. Other areas have vigorous stands of white oak. The erosion hazard, the equipment limitation, the seedling mortality rate, and the windthrow hazard are management concerns.

The main limitations affecting building site development and onsite waste disposal are the depth to bedrock and slope in areas of the Lily and Ramsey soils and slow permeability, wetness, and slope in areas of the Hobson soils.

6. Menfro Association

Very deep, gently sloping to steep, well drained, silty soils; on uplands

This association is on the "River Hills," a 1- to 3-mile band of loess-covered ridgetops and highly dissected lower side slopes adjacent to the flood plains along the Missouri River. Some of the ridgetops end at cliffs overlooking the river channel or flood plain.

This association makes up about 9 percent of the county. It is about 75 percent Menfro and similar soils and 25 percent minor soils.

The Menfro soils are on ridgetops, side slopes, and high terraces. Typically, the surface layer is brown silt loam. The subsoil is dark yellowish brown and dark brown silty clay loam and silt loam. The substratum is dark brown silt loam.

Of minor extent in this association are the moderately deep Gatewood soils on the lower south-facing slopes, the somewhat poorly drained Hartville soils on foot slopes and low terraces, and the nearly level Haymond soils on flood plains.

About 65 percent of this association is cleared and is used for hay, pasture, cultivated crops, or urban or residential development. Corn, soybeans, and small grain are the main cultivated crops. Livestock production is a major enterprise. Control of erosion is a primary management concern in cultivated areas. Both sheet and gully erosion can be severe.

Nearly all of the uncleared acreage is on the steep, heavily dissected slopes along drainageways. The timber stands include many good-quality white oaks and other hardwoods. The erosion hazard and the equipment limitation are management concerns on the steeper slopes. Measures that improve the stands and protect them from grazing are needed.

Because of the diversity and dispersion of cover types and the abundance of food and water, this association provides good habitat for both woodland and openland wildlife.

The areas used for building site development and onsite waste disposal are mainly on the ridgetops, where the Menfro soils have no severe limitations affecting these uses. The slope is a moderate limitation in the less sloping areas. The shrink-swell potential also is a moderate limitation.

7. Blake-Waldron-Haynie Association

Very deep, nearly level, somewhat poorly drained and well drained, silty, clayey, and loamy soils; on flood plains

These soils are on the flood plains along the Missouri River. They formed in recent alluvium. Differences among the soils are largely the result of the texture of the material in which each soil formed. Differences in elevation are slight, but they are important in the distribution of the soils on the flood plains.

This association makes up about 3 percent of the county. It is about 32 percent Blake soils, 31 percent Waldron soils, 22 percent Haynie and similar soils, and 15 percent minor soils.

The Blake soils are somewhat poorly drained. They generally are in areas intermediate in elevation between the Haynie and Waldron soils. Typically, the surface layer is very dark grayish brown silty clay loam. The substratum is dark grayish brown, stratified silty clay loam and silt loam. It has a few thin strata of brown and dark gray silty clay.

The Waldron soils are somewhat poorly drained. They are in the lower areas. Typically, the surface layer

is very dark grayish brown silty clay. The substratum is stratified very dark grayish brown silty clay loam and dark gray and dark grayish brown silty clay.

The Haynie soils are well drained. They are mainly in the higher areas. Typically, the surface layer is very dark grayish brown very fine sandy loam. The substratum is stratified dark grayish brown and dark brown silt loam and dark grayish brown very fine sandy loam.

Of minor extent in this association are the somewhat excessively drained, sandy Hodge soils near levee breaks and in other areas of rapid water deposition and the very poorly drained, clayey Booker soils in the lowest slack-water areas.

About 90 percent of this association is intensively cultivated. Corn, soybeans, and wheat are the main crops. Some alfalfa is grown, mainly on the sandy Hodge soils. The wetness of the Blake and Waldron soils is the main management concern. Ditches or land grading improves surface drainage. Irrigation can improve productivity in most years. The association is well suited to irrigation.

Uncleared areas, most of which are not protected by levees, provide excellent habitat for deer, turkeys, waterfowl, and furbearers. Cottonwood, silver maple, and boxelder are the dominant timber species. Pecan trees grow well on these soils, and isolated ones have been spared in cleared areas. The equipment limitation on the Waldron soils and seedling mortality on the Hodge and Waldron soils are the main concerns in planting or harvesting trees.

This association generally is unsuitable for building site development and onsite waste disposal because of the wetness of the Blake and Waldron soils and the hazard of flooding on all of the major soils.

8. Haymond-Pope Association

Very deep, nearly level, well drained, silty and loamy soil; on flood plains and low terraces

This association is on the flood plains and stream terraces along the Meramec and Bourbeuse Rivers and along the major creeks in the county. It occurs as long, winding bands, generally 0.25 to 0.5 mile wide, that follow the entrenched meanders typical of these streams. The soils formed in alluvium derived from the Ozark highlands.

This association makes up about 8 percent of the county. It is about 37 percent Haymond and similar soils, 28 percent Pope and similar soils, and 35 percent minor soils.

The Haymond soils are on flood plains. Typically, the surface layer is dark grayish brown silt loam. The substratum is brown silt loam.

The Pope soils are on flood plains and low stream terraces. Typically, the surface layer is dark brown loam. The subsurface layer is dark yellowish brown loam. The subsoil and substratum are dark brown loam.

Of minor extent in this association are the somewhat excessively drained Cedargap soils along creeks, the somewhat poorly drained Hartville soils on foot slopes, and the poorly drained Twomile and Bremer soils on stream terraces and in cutoff stream meanders.

More than 80 percent of this association has been cleared of trees and is used for cultivated crops or for hay and pasture. Corn, soybeans, and wheat are the main crops. Flooding is a hazard. It occurs mainly during winter and early spring.

This association provides habitat for both woodland and openland wildlife. Grain that is left in the fields when soybeans and corn are harvested provides winter food for deer, turkeys, and squirrels. Wooded areas occur mainly as narrow strips next to streams. Cover for woodland wildlife generally is not available on these narrow flood plains but is available on the adjacent uplands.

This association generally is unsuitable for building site development and onsite waste disposal because of the flooding. In December 1982, record flooding swept away or demolished scores of clubhouses, dwellings, and other buildings along the Meramec and Bourbeuse Rivers.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, 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, Menfro silt loam, 2 to 5 percent slopes, is a phase of the Menfro series.

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

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

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

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

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

1B2—Union silt loam, 2 to 5 percent slopes, eroded. This very deep, gently sloping, moderately well drained soil is on high ridgetops in the uplands. Individual areas are long and narrow and range from 60 to 200 acres in size.

Typically, the surface layer is brown, very friable silt loam about 5 inches thick. The subsoil extends to a depth of more than 60 inches. In sequence downward, it is yellowish brown, friable silty clay loam; strong brown and dark brown, mottled, firm silty clay; dark brown, mottled, firm silty clay loam; a fragipan of dark yellowish brown, very hard, brittle silt loam and brown,

mottled, very firm, brittle very cherty silt loam; and yellowish brown, mottled, firm clay. In several areas, the soil is not eroded and the surface soil is very dark grayish brown and dark grayish brown silt loam 10 or more inches thick. In places the subsoil is clay loam.

Included with this soil in mapping are some areas of a nearly level, poorly drained soil that has a light gray subsurface layer, a subsoil of silty clay, and an abrupt boundary between the subsurface layer and the subsoil. This included soil is in the middle of some broad ridges. Also included are some severely eroded areas where the plow layer is brown silty clay loam. Included soils make up about 10 percent of the unit.

Permeability is moderate in the upper part of the Union soil, slow in the fragipan, and moderately slow below the pan. Available water capacity is moderate. Runoff is slow in cultivated areas. Natural fertility is low, and the content of organic matter is moderately low. The surface layer is friable and can be easily tilled. Root development is severely restricted by the fragipan below a depth of about 30 inches. A perched water table is at a depth of 1.5 to 3.0 feet for brief periods in late winter and early spring. The shrink-swell potential is moderate above the fragipan.

Most areas of this soil are used for pasture or hay, but a considerable acreage is used for cultivated crops. Grain sorghum and wheat are the principal crops, and a minor acreage is used for corn or soybeans. A few areas remain forested.

The suitability of this soil for different crops depends largely on the needs of each crop for soil moisture. Less than 7 inches of water is available for plant growth in this soil. This is not enough to prevent serious moisture stress during the summer of most years. Consequently, the soil is better suited to grain sorghum than to corn or soybeans and is somewhat better suited to soybeans than to corn. It is well suited to small grain. If corn is grown, high plant populations should be avoided and planting early in spring is beneficial in most years. During wet periods planting or harvesting may be delayed by seepage of ground water moving laterally above the fragipan.

If this soil is cultivated, erosion is a severe hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, a combination of terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay at least every other year. Grade-stabilization structures may be needed where grassed waterways are established. The cost effectiveness of terraces and other mechanical erosion-control measures is questionable on this soil.

This soil is well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as orchardgrass and tall fescue; and to warm-season grasses, such as big bluestem and indiangrass. It also is well suited to ladino clover and red clover if lime is applied. The rooting depth is only moderate, and an insufficient moisture supply is a problem during summer. Erosion control is needed in areas where the pasture is tilled and newly seeded. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

Very little of the native hardwood forest remains on this soil, but a few tracts have been planted to pine. Although the rooting depth is somewhat restricted by the fragipan, no major problems affect tree growth, planting, or harvesting.

If this soil is used for building site development or onsite waste disposal, the shrink-swell potential and the wetness are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and floors and by backfilling with sand and gravel. The wetness can be reduced by installing tile drains around footings and foundations. Septic tank absorption fields do not function well because of the wetness and the slowly permeable fragipan. Properly designed sewage lagoons can function adequately if the site is leveled.

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

1C2—Union silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, moderately well drained soil is on high ridgetops and on smooth upper side slopes in the uplands. Individual areas are long and narrow. Some extend for several miles and are several hundred acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil extends to a depth of more than 60 inches. In sequence downward, it is strong brown, friable silty clay loam; brown, mottled, firm silty clay; brown, mottled, firm silty clay loam; a fragipan of brown, mottled, very firm, hard, compact silt loam and very cherty silt loam; and strong brown, mottled, very firm clay. In several areas, the soil is not eroded and the surface soil is very dark grayish brown and dark grayish brown silt loam 10 or more inches thick. In places the subsoil is clay loam.

Included with this soil in mapping are scattered small areas of the cherty Beemont soils and some severely eroded areas where the plow layer is brown silty clay

loam. Also included are some areas of a nearly level, poorly drained soil that has a thick, light gray subsurface layer. Included soils make up about 10 percent of the unit.

Permeability is moderate in the upper part of the Union soil, slow in the fragipan, and moderately slow below the pan. Available water capacity is moderate. Runoff is medium in cultivated areas. Natural fertility is low, and the content of organic matter is moderately low. The surface layer is friable and can be easily tilled. Root development is severely restricted by the fragipan below a depth of about 28 inches. A perched water table is at a depth of 1.5 to 3.0 feet for brief periods during winter and early spring. The shrink-swell potential is moderate in the subsoil.

Most areas of this soil are used for pasture or hay, but a considerable acreage is used for cultivated crops, principally grain sorghum and wheat. A small acreage is used for corn or soybeans. A substantial acreage remains forested.

The suitability of this soil for different crops depends largely on the needs of each crop for soil moisture. Less than 7 inches of water is available for plant growth in this soil. This is not enough to prevent serious moisture stress during the summer of most years. Consequently, the soil is better suited to grain sorghum than to corn or soybeans and is somewhat better suited to soybeans than to corn. It is well suited to small grain. If corn is grown, high plant populations should be avoided and planting early in spring is beneficial in most years. During wet periods planting or harvesting may be delayed by seepage of ground water moving laterally above the fragipan.

If this soil is cultivated, erosion is a severe hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, a combination of terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay during at least 3 out of every 4 years. Grade-stabilization structures may be needed where grassed waterways are established. The cost effectiveness of terraces and other mechanical erosion-control measures is questionable on this soil. Some areas are unsuitable for terracing because they are long and narrow and have complex slopes.

This soil is well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and indiangrass. It also is well suited to ladino clover and red clover if lime is applied. The rooting depth is only moderate, and an insufficient moisture supply is a problem during summer. Erosion control is needed in areas where the pasture is tilled and newly seeded. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

A substantial acreage supports native hardwoods. Some areas that formerly were cleared of trees and farmed are reverting to forest. Some tracts have been planted to pine. In most of the wooded areas, selective cutting and stand improvement are needed. Although the rooting depth is somewhat restricted by the fragipan, no major problems affect tree growth, planting, or harvesting.

If this soil is used for building site development, the shrink-swell potential and the wetness are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and floors and by backfilling with sand and gravel. The wetness can be reduced by installing tile drains around footings and foundations. Septic tank absorption fields do not function well because of the wetness and the slowly permeable fragipan. Properly designed sewage lagoons can function adequately if the site can be leveled.

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

1D2—Union silt loam, 9 to 14 percent slopes, eroded. This very deep, strongly sloping, moderately well drained soil commonly is on north-facing side slopes and the tops of narrow ridges in the uplands. Most areas range from about 6 to 40 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil extends to a depth of more than 60 inches. In sequence downward, it is strong brown, friable silty clay loam; brown, mottled, firm silty clay; dark yellowish brown, mottled silty clay loam; a fragipan of brown, mottled, very firm, hard, compact silt loam and very cherty silt loam; and strong brown, mottled, very firm clay. In some areas the soil does not have a fragipan. In several areas, the soil is not eroded and the surface soil is very dark grayish brown and dark grayish brown silt loam 10 or more inches thick.

Included with this soil in mapping are some small areas of the cherty Beemont soils, generally along drainageways. Also included are cultivated areas where erosion has removed most of the original surface layer and the plow layer is brown silty clay loam. Included soils make up about 10 percent of the unit.

Permeability is moderate in the upper part of the Union soil, slow in the fragipan, and moderately slow

below the pan. Available water capacity is moderate. Runoff is rapid in cultivated areas. Natural fertility is low, and the content of organic matter is moderately low. The surface layer is friable and can be easily tilled. Root development is severely restricted by the fragipan below a depth of about 26 inches. A perched water table is at a depth of 1.5 to 3.0 feet for brief periods during winter and early spring. The shrink-swell potential is moderate in the subsoil.

Most cleared areas are used for pasture or hay. A small acreage is used for cultivated crops, principally grain sorghum and wheat. Because of a severe hazard of erosion and the complex slopes, this soil is not suited to cultivated crops. It is well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and indiangrass. It also is well suited to ladino clover and red clover if lime is applied. The rooting depth is only moderate, and an insufficient moisture supply is a problem during summer. Erosion control is needed in areas where the pasture is tilled and newly seeded. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

A large acreage of this soil is native forest. Some tracts have been planted to pine. In most of the wooded areas, selective cutting and stand improvement are needed. Although the rooting depth is somewhat restricted by the fragipan, no major problems affect tree growth, planting, or harvesting.

If this soil is used for building site development, the shrink-swell potential, the wetness, and the slope are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and floors and by backfilling with sand and gravel. The wetness can be reduced by installing tile drains around footings and foundations. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. Septic tank absorption fields do not function well because of the slowly permeable fragipan. Installation of sewage lagoons is severely limited by the slope, but the lagoons can function adequately if the site can be sufficiently leveled. Alternative sites that are better suited to onsite waste disposal may be available.

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

2D—Goss cherty silt loam, 9 to 14 percent slopes. This very deep, strongly sloping, well drained soil is on ridgetops and the upper side slopes in the uplands. Individual areas are mainly long and narrow and range from 10 to 80 acres in size.

Typically, the surface layer is very dark grayish brown cherty silt loam about 4 inches thick. The subsurface layer is brown very cherty silt loam about 16 inches thick. The subsoil to a depth of 60 inches is very cherty silty clay. It is yellowish red in the upper part and red in the lower part. On most north-facing foot slopes, the surface layer is silt loam. In places bedrock is within a depth of 60 inches.

Included with this soil in mapping are small areas of Union and Hobson soils, both of which have a fragipan. These soils are in the less sloping areas in the middle of some ridges. They make up about 10 percent of the unit.

Permeability is moderate in the Goss soil. Available water capacity is very low. Runoff is rapid. Natural fertility is low, and the content of organic matter is moderately low. The chert hinders tillage. No serious restrictions affect root development. The shrink-swell potential is moderate in the subsoil.

Most areas remain forested, but a considerable acreage on foot slopes has been cleared of trees and is used for pasture. Because of a severe hazard of erosion, droughtiness, and the chert fragments, this soil is unsuited to cultivated crops. It is suited to legumes, such as birdsfoot trefoil and lespedeza; to cool-season grasses, such as tall fescue; and to warm-season grasses, such as big bluestem and indiangrass. The droughtiness, the hazard of erosion during seedbed preparation, and the chert in the surface layer are the main concerns in managing pasture. Preparing a seedbed in a timely manner and on the contour can result in a good ground cover.

The forested areas dominantly support white oak. A few cleared tracts have been planted to pine. In most of the wooded areas, stand improvement and selective cutting are needed. No major problems affect tree growth, planting, or harvesting.

If this soil is used for building site development, the shrink-swell potential, the slope, and large stones are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls, footings, and floors and by backfilling with sand or gravel. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. Some of the stones should be removed, or backfill should be added.

If used for onsite waste disposal, this soil is limited by the slope, the large stones, and the moderate permeability. Septic tank absorption fields can function

adequately if the distribution lines are installed across the slope and the absorption area is large enough to compensate for the moderate permeability. Some of the largest stones should be removed. The soil generally is unsuitable as a site for sewage lagoons because of the large stones, the slope, and seepage.

The land capability classification is VIs. The woodland ordination symbol is 3F.

2F—Goss cherty silt loam, 14 to 45 percent slopes. This very deep, moderately steep to very steep, well drained soil is on side slopes in the uplands. The landscape is dissected by V-shaped drainageways. Most areas are several hundred acres in size.

Typically, the surface layer is very dark grayish brown, friable cherty silt loam about 3 inches thick. The subsurface layer is pale brown and yellowish brown, friable cherty and very cherty silt loam about 18 inches thick. The subsoil to a depth of 60 inches or more is red, very firm very cherty clay. On most of the less sloping, north-facing slopes, the surface layer is silt loam. In places bedrock is within a depth of 60 inches.

Included with this soil in mapping are small areas of the moderately deep Lily and shallow Ramsey soils, both of which are underlain by sandstone bedrock. Also included are some areas of the moderately deep Bardley and shallow Gasconade soils on the steeper parts of the landscape. Included soils make up about 15 percent of the unit.

Permeability is moderate in the Goss soil. Available water capacity is very low. Runoff is rapid. Natural fertility is low, and organic matter content is moderately low. No restrictions affect root development. The shrink-swell potential is moderate in the subsoil.

Most areas remain forested. A few areas have been cleared of trees and are used as pasture. Most of these are moderately steep areas on the north-facing slopes where the surface layer is silt loam. Because of a severe hazard of erosion, the high content of chert, the slope, and droughtiness, this soil is unsuited to cultivated crops. It generally is unsuitable as hayland because of the slope. It is moderately suited to legumes, such as birdsfoot trefoil and lespedeza; to cool-season grasses, such as tall fescue, and to warm-season grasses, such as big bluestem and indiangrass. The droughtiness, the hazard of erosion during seedbed preparation, and the chert in the surface layer are the main concerns in managing pasture.

A considerable amount of fair- or good-quality white oak is harvested in the areas of native forest. In most of the wooded areas, selective cutting and stand improvement are needed. The use of equipment is limited because of the slope. Sites for logging roads and skid trails should be carefully selected. A few abandoned fields have been hand planted to pine. These are mainly on moderately steep, north- and east-facing slopes. No major problems affect tree growth, planting, or harvesting on these slopes. Seedling mortality generally is much higher on south-facing slopes, where reinforcement planting or replanting may be needed.

Mainly because of the slope, this soil is severely limited as a site for buildings and sanitary facilities. Costly measures are required to overcome this limitation. Better suited sites generally are nearby.

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

3—Twomile silt loam. This very deep, nearly level, poorly drained soil is on stream terraces along many of the streams in the county. It is subject to rare flooding of brief duration. Most areas range from 6 to 100 acres in size.

Typically, the surface layer is brown, very friable silt loam about 12 inches thick. The subsurface layer is light brownish gray silt about 18 inches thick. It is friable in the upper part and mottled, compact, brittle, and firm in the lower part. The subsoil is about 23 inches of grayish brown, mottled, firm silty clay loam and silt loam. The substratum to a depth of 60 inches or more is multicolored, friable silt loam. In places the subsurface layer is not compact and brittle.

Included with this soil in mapping are some scattered small areas of the somewhat poorly drained Auxvasse soils. These soils make up about 10 percent of the unit.

Permeability is slow in the Twomile soil, and available water capacity is low. Runoff is slow. Natural fertility is low, and the content of organic matter is moderately low. The surface layer is friable and can be easily tilled. Root development is limited. Roots tend to concentrate in cracks in the compact subsurface layer. A perched water table is at a depth of 1 to 2 feet during winter and spring. The shrink-swell potential is moderate in the subsoil.

Most of the larger areas of this soil are used for cultivated crops. Grain sorghum, soybeans, and wheat are the principal crops. A limited acreage is used for corn. Many areas are used for pasture or hay, and some remain forested.

The suitability of this soil for different crops depends on needs of the crop for soil moisture and its ability to withstand wetness. The compact and brittle subsurface layer severely restricts the movement of air and water. The supply of moisture is deficient in summer, and

wetness is a limitation early in spring. Less than 6 inches of water is available for plant growth in this soil, despite favorable textures throughout. As a result, severe moisture stress occurs during the summer of most years. Deep plowing or subsoiling can shatter the subsurface layer and thus increase the rooting depth and the available water capacity. Applications of lime reduce the acidity of this layer.

If drainage is improved by shallow surface ditches, this soil is well suited to wheat and other small grain crops. Unless irrigated, it is poorly suited to corn. Soybeans and grain sorghum grow better than corn during periods of insufficient rainfall.

This soil is moderately suited to water-tolerant, shallow-rooted legumes, such as alsike clover, and to cool-season grasses, such as tall fescue and reed canarygrass. It is poorly suited to warm-season grasses and to hay. Grazing should be avoided during wet periods. A surface drainage system improves the suitability for the deeper rooted species.

The areas of native forest dominantly support water-tolerant tree species, such as pin oak, bur oak, swamp white oak, shellbark hickory, and green ash. Seedling mortality and windthrow are management concerns. Reinforcement planting may be needed. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. The trees should be harvested when the amount of soil moisture is not excessive.

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

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

5B—Hartville silt loam, 2 to 5 percent slopes. This very deep, gently sloping, somewhat poorly drained soil is on stream terraces and along ancient cutoff stream meanders. Most areas range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. It is firm. It is dark yellowish brown, mottled silty clay loam and brown, mottled silty clay in the upper part; multicolored silty clay loam in the next part; and grayish brown, mottled silty clay loam in the lower part. In places the content of chert in the subsoil is 10 to 20 percent. In some eroded areas brown silty clay loam from the subsoil is mixed with the plow layer.

Included with this soil in mapping are small areas of a soil that has a dark surface layer and has a fragipan at a depth of 26 to 30 inches. This included soil is along the upstream limits of some small drainageways at the higher elevations. It makes up about 5 percent of the unit. Also included are some areas of a soil that is subject to rare flooding of brief duration. This soil makes up about 5 percent of the unit.

Permeability is slow in the Hartville soil. Available water capacity is moderate. Runoff is medium. Natural fertility is low, and the content of organic matter is moderately low. The surface layer is friable and can be easily tilled. A perched water table is at a depth of 1.5 to 3.0 feet during winter and early spring in most years. Root development is somewhat restricted because of the content of clay in the subsoil. The shrink-swell potential is high in the subsoil.

Nearly all areas of this soil have been cleared of trees and are used for cultivated crops, pasture, or hay. Corn, soybeans, wheat, and grain sorghum are the principal crops. Only a small acreage remains forested.

This soil is well suited to soybeans, grain sorghum, and small grain. About 8 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress in corn during the summer of most years if high plant populations are avoided and the crop is planted early in spring. The wetness, however, delays spring planting in most years. Erosion is a moderate hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, contour farming, and a cropping sequence that includes pasture or hay during at least 1 year out of every 4.

This soil is well suited to most of the commonly grown legumes, such as ladino clover, red clover, and lespedeza; to cool-season grasses, such as orchardgrass and reed canarygrass; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Erosion control during seedbed preparation is the main management need. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

The trees on this soil are mainly shade trees and ornamental plantings. Because of the seedling mortality rate, the species selected for planting should be those that can withstand wetness. Some timely thinning may be needed because of the damage caused by windthrow.

This soil is limited as a site for buildings because of the shrink-swell potential and the wetness. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete

in basement walls and floors and by backfilling with sand and gravel. The wetness can be reduced by installing tile drains around footings and foundations. Septic tank absorption fields do not function adequately because of the wetness and the slowly permeable subsoil. Properly designed sewage lagoons can function well if the site can be leveled.

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

5C—Hartville silt loam, 5 to 9 percent slopes. This very deep, moderately sloping, somewhat poorly drained soil is on stream terraces and foot slopes. Most areas range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is yellowish brown, friable silt loam about 4 inches thick. The subsoil extends to a depth of 60 inches or more. It is firm. It is dark yellowish brown, mottled silty clay loam in the upper part; dark grayish brown, mottled silty clay in the next part; and dark grayish brown silty clay loam in the lower part. In places the content of chert in the subsoil is 10 to 20 percent.

Included with this soil in mapping are scattered small areas of the well drained Bucklick soils. Also included are some severely eroded areas. Included soils make up about 10 percent of the unit.

Permeability is slow in the Hartville soil. Available water capacity is moderate. Runoff is medium in cultivated areas. Natural fertility is low, and the content of organic matter is moderately low. The surface layer is friable and can be easily tilled. Root development is somewhat restricted because of the content of clay in the subsoil. A perched water table is at a depth of 1.5 to 3.0 feet during most winter and spring months. The shrink-swell potential is high in the subsoil.

Most areas of this soil are used for pasture or hay. A considerable acreage is used for cultivated crops. Corn, soybeans, wheat, and grain sorghum are the principal crops. They generally are grown in rotation with pasture or hay. Some small tracts remain forested.

This soil is suited to cultivated crops. It generally is better suited to grain sorghum and soybeans than to corn. It is well suited to small grain. About 8 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress in corn during the summer of most years if the crop is planted early in spring and high plant populations are avoided. The wetness delays spring planting in some years.

Erosion is a serious hazard in the areas used for cultivated crops. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay at least every other year. Grade-stabilization structures may be needed where grassed waterways are established.

This soil is well suited to most of the commonly grown legumes, such as ladino clover, red clover, and lespedeza; to cool-season grasses, such as orchardgrass and reed canarygrass; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. Erosion control during seedbed preparation is the main management need. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

In the areas of native hardwood forest, the dominant species are those that can withstand wetness, such as pin oak, shingle oak, swamp white oak, and green ash. Because of the seedling mortality rate, the species selected for planting should be those that can withstand wetness. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

If this soil is used for building site development, the shrink-swell potential and the wetness are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and floors and by backfilling with sand and gravel. The wetness can be reduced by installing tile drains around footings and foundations. Septic tank absorption fields do not function well because of the slowly permeable subsoil. Properly designed sewage lagoons can function adequately if the site can be leveled.

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

6B—Bucklick silt loam, 2 to 5 percent slopes. This deep, gently sloping, well drained soil is on the tops of ridges in the uplands. Individual areas are long and narrow or are oval. They range from about 5 to 30 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is about 42 inches thick. It is firm. It is strong brown silty clay loam in the upper part, yellowish red silty clay in the next part, and yellowish red cherty silty clay in the lower part. Hard dolomite bedrock is at a depth of about 48 inches. In places it is within a depth of 40 inches. In a few eroded areas, strong brown silty clay loam from the subsoil is mixed with the plow layer.

Included with this soil in mapping are some areas of the moderately deep Gatewood and shallow Gasconade soils. These soils are mainly at the end of ridges. They make up about 15 percent of the unit.

Permeability and available water capacity are moderate in the Bucklick soil. Runoff is medium. Natural fertility is low, and the content of organic matter is moderate. The surface layer is friable and can be easily tilled. No restrictions affect root development above the bedrock. The shrink-swell potential is high in the subsoil.

Most areas of this soil are used for pasture or hay, but a considerable acreage is cultivated. Wheat and grain sorghum are the principal crops. A minor acreage is used for corn or soybeans. A few areas remain forested.

The suitability of this soil for different crops depends on the needs of each crop for soil moisture. About 7 inches of water is available for plant growth in this soil. This is not enough to prevent serious moisture stress during the summer of most years. As a result, the soil is somewhat better suited to soybeans and grain sorghum than to corn. It is well suited to small grain. If corn is grown, high plant populations should be avoided and the crop should be planted early in spring.

If this soil is cultivated, erosion is a moderate hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay during at least 1 year out of every 4. Grade-stabilization structures may be needed where grassed waterways are established. The cost effectiveness of terraces and other mechanical erosion-control structures is questionable on this soil.

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

Very few areas of this soil support native hardwoods. A few tracts have been planted to pine. No major problems affect tree growth, planting, or harvesting.

If this soil is used for building site development, the shrink-swell potential and the depth to bedrock are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and floors and by backfilling with sand and gravel. If a basement is constructed, blasting may be needed to remove the bedrock. Septic tank absorption fields can function adequately if the depth to bedrock is increased by additions of silty borrow material and the absorption area is large enough to compensate for the moderate permeability. Properly designed sewage lagoons also can function adequately if the site can be leveled, the lagoon is sealed with slowly permeable material, and enough soil material is available to construct the bottom and berms of the lagoon.

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

6C—Bucklick silt loam, 5 to 9 percent slopes. This deep, moderately sloping, well drained soil is mainly on the tops of ridges in the uplands. In places it is on side slopes. Individual areas generally are long and narrow and range from 6 to 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is about 42 inches thick. It is firm. It is dark yellowish brown silty clay loam in the upper part, strong brown silty clay in the next part, and yellowish red cherty silty clay in the lower part. Hard dolomite bedrock is at a depth of about 48 inches. In places it is at a depth of more than 60 inches.

Included with this soil in mapping are some scattered areas of the moderately deep Gatewood and shallow Gasconade soils. Also included are some eroded areas where the surface layer is brown silty clay loam. Included soils make up about 15 percent of the unit.

Permeability and available water capacity are moderate in the Bucklick soil. Runoff is medium in cultivated areas. Natural fertility is low, and the content of organic matter is moderate. The surface layer is friable and can be easily tilled. No serious restrictions affect root development above the bedrock. The shrink-swell potential is high in the subsoil.

This soil is used primarily for pasture or hay. Many small areas are cultivated. A large acreage remains forested.

The suitability of this soil for different crops depends on the needs of each crop for soil moisture. About 7 inches of water is available for plant growth in this soil. This is not enough to prevent serious moisture stress during the summer of most years. Consequently, the soil is somewhat better suited to soybeans and grain sorghum than to corn. It is well suited to small grain. If corn is grown, high plant populations should be avoided and the crop should be planted early in spring.

If this soil is cultivated, erosion is a severe hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay at least every other year. Grade-stabilization structures may be needed where grassed waterways are established. The cost effectiveness of terraces and other mechanical erosion-control practices is questionable on this soil.

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

A considerable acreage is native forest. Some tracts have been planted to pine. In many of the wooded areas, selective cutting and stand improvement are needed. No major problems affect tree growth, planting, or harvesting.

If this soil is used for building site development, the shrink-swell potential and the depth to bedrock are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and floors and by backfilling with sand and gravel. If a basement is constructed, blasting may be needed to remove the bedrock. Septic tank absorption fields can function adequately if the depth to bedrock is increased by additions of silty borrow material and the absorption area is large enough to compensate for the moderate permeability. The soil is severely limited as a site for sewage lagoons because of the slope.

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

6D—Bucklick silt loam, 9 to 14 percent slopes. This deep, strongly sloping, well drained soil is mainly on smooth, convex side slopes in the uplands. Individual areas generally range from 10 to 80 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 6 inches thick. The subsoil is about 44 inches thick. It is firm. It is yellowish red silty clay loam and silty clay in the upper part; yellowish red, mottled silty clay in the next part; and yellowish red, mottled very cherty silty clay and brown silty clay in the lower part. Hard dolomite bedrock is at a depth of about 50 inches. In places the depth to bedrock is more than 60 inches.

Included with this soil in mapping are some small areas of the moderately deep Gatewood soils and a few areas of rock outcrop, generally on south-facing slopes. Also included are some areas where erosion has removed most of the original surface layer and the remaining surface layer is brown silty clay loam. Included soils make up about 10 percent of the unit.

Permeability and available water capacity are moderate in the Bucklick soil. Runoff is rapid. Natural fertility is low, and the content of organic matter is moderate. The surface layer is friable and can be easily tilled. Root development is somewhat restricted by a high content of clay in the subsoil. The shrink-swell potential is high in the subsoil.

Most areas of this soil have been cleared of trees and formerly were cultivated. They currently are used primarily for pasture or hay, but a considerable acreage is used for cultivated crops. Some areas are forested.

If erosion is controlled, this soil is suited to cultivated crops that are grown on a limited basis. The suitability for different crops depends largely on the needs of each crop for soil moisture. About 7 inches of water is available for plant growth in this soil. This is not enough to prevent serious moisture stress during the summer of most years. The rapid runoff rate increases the likelihood of summer stress. The soil is better suited to drilled or no-till soybeans and grain sorghum than to corn. It is well suited to small grain.

If this soil is cultivated, erosion is a severe hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay during at least 3 out of every 4 years. Grade-stabilization structures generally are needed if grassed waterways are established. The cost effectiveness of terraces and other mechanical erosion-control practices is questionable on this soil.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as orchardgrass and timothy; and to warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation is a major management concern. Preparing a seedbed in a timely manner and on the contour helps to ensure a good ground cover. Measures that maintain fertility and control brush are needed.

A considerable acreage remains native forest. A substantial acreage of abandoned farmland, mainly in

eroded areas, is reverting to forest. Some tracts have been planted to pine. In most of the wooded areas, selective cutting and stand improvement are needed. No major problems affect tree growth, planting, or harvesting.

If this soil is used for building site development, the shrink-swell potential, the depth to bedrock, and the slope are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and floors and by backfilling with sand and gravel. The building should be designed so that it conforms to the natural slope of the land. If a basement is constructed, blasting may be needed to remove the bedrock. Septic tank absorption fields can function adequately if the distribution lines are installed across the slope, the depth to bedrock is increased by additions of silty borrow material, and the absorption area is large enough to compensate for the moderate permeability. The soil is severely limited as a site for sewage lagoons because of the slope.

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

6E—Bucklick silt loam, 14 to 20 percent slopes. This deep, moderately steep, well drained soil is on side slopes in the uplands. Individual areas range from 10 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 38 inches thick. It is firm. It is strong brown silty clay loam in the upper part; yellowish red silty clay in the next part; and yellowish red, mottled cherty silty clay in the lower part. The substratum is brown, firm clay about 2 inches thick. Hard dolomite bedrock is at a depth of about 46 inches. In places the depth to bedrock is more than 60 inches.

Included with this soil in mapping are some areas of the moderately deep Gatewood soils, mainly along drainageways. Also included are some eroded areas where the surface layer is brown silty clay loam. Included soils make up about 10 percent of the unit.

Permeability and available water capacity are moderate in the Bucklick soil. Runoff is rapid. Natural fertility is low, and the content of organic matter is moderate. The surface layer is friable and can be easily tilled. No restrictions affect root development above the bedrock. The shrink-swell potential is high in the subsoil.

Most areas are pastured or forested. Some are used for hay. A small acreage is used for cultivated crops. Because of the slope and a severe hazard of erosion, this soil is unsuited to cultivated crops. It is suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as orchardgrass and timothy; and to warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main concerns in managing pastured areas. Preparing a seedbed in a timely manner and on the contour helps to ensure a good ground cover. Measures that maintain fertility and control brush are necessary.

Most of the forested acreage formerly was cultivated. It supports second-growth species. A few areas have been planted to pine. In some areas stand improvement and selective cutting are needed. Erosion is a moderate hazard on logging roads and skid trails. It can be controlled by carefully selecting sites for the roads and trails and by building small water breaks at selected intervals. Seeding may be needed in some disturbed areas.

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

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

6F—Bucklick-Gatewood complex, 20 to 35 percent slopes. These steep soils are on dissected, north-facing side slopes in the uplands. The deep, well drained Bucklick soil is in areas between drainageways. The moderately deep, moderately well drained Gatewood soil is along the drainageways and at the head of draws. Most areas range from 20 to 150 acres in size. They are about 40 percent Bucklick soil and 40 percent Gatewood soil. The two soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of Bucklick soil is dark brown, friable silt loam about 4 inches thick. The subsurface layer is dark yellowish brown silt loam about 5 inches thick. The subsoil is about 36 inches thick. It is firm. It is reddish brown silty clay in the upper part, yellowish red silty clay in the next part, and dark reddish brown cherty silty clay in the lower part. Hard dolomite bedrock is at a depth of about 45 inches.

Typically, the surface layer of the Gatewood soil is dark grayish brown, friable cherty silt loam about 3 inches thick. The subsurface layer is yellowish brown and strong brown, friable cherty silt loam about 7 inches thick. The subsoil is dark brown, firm clay about 14 inches thick. The substratum is dark brown clay about 4 inches thick. Hard dolomite bedrock is at a depth of about 28 inches.

Included with these soils in mapping are some areas of the very deep Crider soils on the lower interfluves between the deeply incised and closely spaced drainageways. Also included are areas of the moderately deep Lily and very deep Holstein soils at the lower elevations. Included soils make up about 20 percent of the unit.

Permeability is moderate in the Bucklick soil and slow in the Gatewood soil. Available water capacity is moderate in the Bucklick soil and low in the Gatewood soil. Runoff is rapid on both soils. Natural fertility is low. The content of organic matter is moderate in the Bucklick soil and low in the Gatewood soil. No restrictions affect root development above the bedrock in the Bucklick soil. Root development in the Gatewood soil is somewhat restricted by a high content of clay in the subsoil and by the depth to bedrock. The shrink-swell potential is high in both soils.

Nearly all of the acreage remains forested and is used mainly for timber and for woodland wildlife habitat. A very small acreage is pastured. Because of the slope and a severe hazard of erosion, these soils are unsuitable for cultivated crops. They are suited to trees. The hazard of erosion and the equipment limitation are the main concerns in managing the woodland. Carefully designing and properly constructing logging roads and skid trails can minimize the steepness and length of slopes and thus help to prevent excessive water concentration and erosion. Some areas should be seeded after the trees are harvested. Operating equipment is hazardous on these slopes. As a result, logging roads and skid trails should be built on the contour. In the steepest areas, the logs should be yarded uphill to the logging roads or skid trails. Hand planting or direct seeding may be needed.

These soils generally are unsuitable for building site development and onsite waste disposal because of the slope of both soils and the depth to bedrock in the Gatewood soil.

The land capability classification is VIIe. The woodland ordination assigned to the Bucklick soil is 3R, and that assigned to the Gatewood soil is 2R.

7B—Menfro silt loam, 2 to 5 percent slopes. This very deep, gently sloping, well drained soil is on broad ridges in the uplands and on high stream terraces. Most areas range from 10 to 30 acres in size.

Typically, the surface layer is brown, very friable silt loam about 8 inches thick. The subsoil is about 48 inches thick. It is brown, friable silt loam in the upper part and dark brown, firm silty clay loam in the lower part. The substratum to a depth of 60 inches or more is brown, friable silt loam. In places it is yellowish red silty clay loam. In a few areas, the soil is eroded and subsoil material is mixed with the plow layer.

Included with this soil in mapping are some scattered small areas of Bucklick soils, which have bedrock at a depth of 40 to 60 inches. These soils make up about 10 percent of the unit.

Permeability is moderate in the Menfro soil. Available water capacity is high. Runoff is medium. Natural fertility also is medium, and the content of organic matter is moderately low. The surface layer is very friable and can be easily tilled. No restrictions affect root development. The shrink-swell potential is moderate in the subsoil.

Nearly all areas of this soil are used for cultivated crops, pasture, or hay. Corn, soybeans, and wheat are the principal crops. The acreage of forest is not significant.

This soil is well suited to cultivated crops. More than 10 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress during the summer of all but the driest years. Erosion is a moderate hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay during at least 1 year out of every 4. Grade-stabilization structures may be needed if grassed waterways are established.

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

The trees on this soil generally are grown for shade and ornamental purposes. No major problems affect tree growth, planting, or harvesting.

If this soil is used for building site development, the shrink-swell potential is a limitation. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and floors and by backfilling with sand and gravel. Properly constructed septic tank absorption fields can function adequately. Properly designed sewage lagoons also can function adequately if the site is leveled and the bottom and sides of the lagoon are compacted or sealed, so that seepage is controlled.

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

7C2—Menfro silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, well drained soil is on the tops of ridges in the uplands. Individual areas are long and narrow and range from 20 to 100 acres in size.

Typically, the surface layer is brown, very friable silt loam about 6 inches thick. The subsoil is about 48 inches thick. It is dark yellowish brown, friable silt loam in the upper part and dark brown, firm silty clay loam in the lower part. The substratum to a depth of 72 inches or more is dark brown, friable silt loam. In a few areas, the soil is not eroded and the surface soil is dark brown and brown silt loam 12 or more inches thick. In some areas, erosion has removed most of the original surface layer and the plow layer is dark yellowish brown silt loam or brown, firm silty clay loam. In places the subsoil is yellowish red silty clay loam.

Included with this soil in mapping are some small areas of Bucklick soils, which have bedrock at a depth of 40 to 60 inches. These soils are mainly around the head of drainageways. They make up about 10 percent of the unit.

Permeability is moderate in the Menfro soil. Available water capacity is high. Runoff is medium. Natural fertility also is medium, and the content of organic matter is moderately low. The surface layer is very friable and can be easily tilled. No restrictions affect root development. The shrink-swell potential is moderate in the subsoil.

Most areas of this soil are used for cultivated crops, pasture, or hay. Corn, soybeans, and wheat are the principal crops. They generally are grown in rotation with hay and pasture. A large acreage has been developed for urban uses or for rural residential uses. Only a few small tracts remain forested.

This soil is well suited to cultivated crops. About 10 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress during the summer of all but the driest years. Erosion is a severe hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay during at least 1 year out of every 4. Grade-stabilization structures generally are needed if grassed waterways are established.

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

The trees on this soil are mainly shade trees and ornamental plantings. No major problems affect tree growth, planting, or harvesting.

If this soil is used for building site development, the shrink-swell potential is a limitation. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and floors and by backfilling with sand and gravel. Properly constructed septic tank absorption fields can function adequately. Properly designed sewage lagoons also can function adequately if the site is leveled and the bottom and sides of the lagoon are compacted or sealed, so that seepage is controlled.

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

7D2—Menfro silt loam, 9 to 14 percent slopes, eroded. This very deep, well drained, strongly sloping soil is on the upper side slopes in the uplands. Most areas range from 20 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is brown and dark brown, firm silty clay loam about 40 inches thick. The substratum to a depth of 72 inches or more is brown, friable silt loam. In places the lower part of the subsoil is yellowish red silty clay loam. In a few areas, the soil is not eroded and the surface soil is dark brown and brown silt loam 12 or more inches thick.

Included with this soil in mapping are some small areas of Bucklick soils, which have bedrock at a depth of 40 to 60 inches. These soils are mainly on south-facing slopes. Also included are some severely eroded areas where the surface layer is brown silty clay loam. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Menfro soil. Available water capacity is high. Runoff is rapid. Natural fertility is medium, and the content of organic matter is moderately low. The surface layer is friable and can be easily tilled. No restrictions affect root development. The shrink-swell potential is moderate in the subsoil.

Most areas of this soil are used for cultivated crops, pasture, or hay. Corn, soybeans, and wheat are the principal crops. They generally are grown in rotation with hay and pasture. A considerable acreage has been developed for urban uses or for rural residential uses. Only a few small tracts remain forested.

If erosion is controlled, this soil is suited to cultivated crops. It is somewhat better suited to drilled soybeans or to sorghum than to corn because of the rapid runoff following hard summer rains. About 9 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress during the summer of most years. Erosion is a severe hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay during at least 3 out of every 4 years. Grade-stabilization structures generally are needed if grassed waterways are established.

This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management concerns. Timely seedbed preparation helps to ensure a good ground cover. Measures that maintain fertility and control brush are needed.

The trees on this soil are mainly shade trees and ornamental plantings. No major problems affect tree growth, planting, or harvesting.

If this soil is used for building site development, the shrink-swell potential and the slope are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and floors and by backfilling with sand and gravel. The buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is needed. Septic tank absorption fields can function adequately if the distribution lines are installed across the slope. The soil generally is unsuitable as a site for sewage lagoons because of the slope.

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

7E2—Menfro silt loam, 14 to 20 percent slopes, eroded. This very deep, well drained, moderately steep soil is on side slopes in the uplands. In places it occupies the entire side slope between a ridgetop and a drainageway. Most areas range from 20 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is dark brown, firm silty clay loam about 40 inches thick. The substratum to a depth of 60 inches or more is brown, friable silt loam. In places the lower part of the subsoil is yellowish red silty clay loam. In a few areas, the soil is not eroded and the surface soil is dark brown and brown silt loam 12 or more inches thick.

Included with this soil in mapping are some small areas of Bucklick soils, which have bedrock at a depth of 40 to 60 inches. These soils are mainly along small drainageways. Also included are some severely eroded areas where the surface layer is brown silty clay loam. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Menfro soil. Available water capacity is high. Runoff is rapid. Natural fertility is medium, and the content of organic matter is moderately low. The surface layer is friable and can be easily tilled. No restrictions affect root development. The shrink-swell potential is moderate in the subsoil.

Most areas of this soil are used for pasture or remain forested. Some of the smoother slopes are used for cultivated crops. Corn, soybeans, and wheat are the principal crops. They are grown in rotation with pasture or hay.

This soil is suited to cultivated crops grown on a limited basis. It is better suited to drilled soybeans or to grain sorghum than to corn because of the rapid runoff following hard rains. About 10 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress during the summer of most years. Erosion is a severe hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay during at least 3 out of every 4 years. Grade-stabilization structures generally are needed if grassed waterways are established.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as orchardgrass and timothy; and to warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management concerns. Preparing a seedbed in a timely manner and on the contour helps to ensure a good ground cover. Measures that maintain fertility and control brush are needed.

A substantial acreage of this soil supports native trees, dominantly good-quality white oak. Some areas of abandoned farmland are reverting to forest, and a few such areas have been planted to pine. In many of the wooded areas, selective cutting and stand improvement are needed. Where timber is harvested,

gully erosion is a serious hazard on logging roads and skid trails. It can be controlled by carefully selecting sites for the roads and trails and by building small check dams or water breaks at selected intervals. The equipment limitation is moderate because of the slope. Logging roads and skid trails should be built on the contour.

If this soil is used for building site development, the shrink-swell potential and the slope are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and floors and by backfilling with sand and gravel. The buildings should be designed so that they conform to the natural slope of the land. Septic tank absorption fields can function adequately if the distribution lines are installed across the slope. Some land shaping generally is needed on sites for buildings and septic tank absorption fields. The soil generally is unsuitable as a site for sewage lagoons because of the slope.

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

7F—Menfro silt loam, 20 to 35 percent slopes. This very deep, well drained, steep soil is on dissected side slopes and in long and narrow, steep-sided draws. In places it occupies the entire side slope between a ridgetop and a drainageway. Most areas range from 20 to 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 35 inches thick. It is dark brown. It is friable silt loam in the upper part and firm silty clay loam in the lower part. The substratum to a depth of 60 inches or more is brown, friable silt loam. In places the lower part of the subsoil is yellowish red silty clay loam.

Included with this soil in mapping are some small areas of the moderately deep Gatewood soils, mainly along small drainageways or on the lower side slopes. These soils make up about 15 percent of the unit.

Permeability is moderate in the Menfro soil. Available water capacity is high. Runoff is very rapid. Natural fertility is medium, and the content of organic matter is moderately low. No restrictions affect root development.

Most areas are used as woodland and as wildlife habitat. A small acreage has been cleared of trees and is used for native pasture. Some wooded areas are pastured along with the adjacent areas. Because of the slope and a severe hazard of erosion, this soil is generally unsuited to cultivated crops and to pasture.

Most of the acreage of this soil supports native trees, dominantly good-quality white oak. Some small tracts that have been cleared of trees are reverting to forest. In many of the wooded areas, selective cutting and stand improvement are needed. Where timber is harvested, gully erosion is a serious hazard on logging roads and skid trails. It can be controlled by carefully selecting sites for the roads and trails and by building small check dams or water breaks at selected intervals. Reseeding may be needed after the trees are harvested. Operating equipment is hazardous because of the slope. Logging roads can be built on the contour. In the steepest areas, the logs should be yarded uphill to logging roads and skid trails.

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

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

8B—Crider silt loam, 2 to 5 percent slopes. This very deep, gently sloping, well drained soil is on high terraces. Most areas range from 5 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsurface layer is dark yellowish brown, friable silt loam about 3 inches thick. The subsoil to a depth of more than 60 inches is firm silty clay loam. It is brown in the upper part and yellowish red in the lower part. In places it is brown throughout. In some areas erosion has mixed subsoil material with the plow layer.

Included with this soil in mapping are scattered small areas of the somewhat poorly drained Hartville soils. These soils make up about 10 percent of the unit.

Permeability is moderate in the Crider soil. Available water capacity is high. Runoff is medium. Natural fertility is also medium, and the content of organic matter is moderate. The surface layer is friable and can be easily tilled. No restrictions affect root development. The shrink-swell potential is moderate in the subsoil.

Nearly all areas are used for cultivated crops, pasture, or hay. Corn, soybeans, and wheat are the principal crops. This soil is well suited to cultivated crops. About 10 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress in summer-grown crops during all but the driest years. Erosion is a moderate hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay

during at least 1 year out of every 4. Grade-stabilization structures generally are needed if grassed waterways are established.

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

The trees on this soil are mainly shade trees and ornamental plantings. No major problems affect tree growth, planting, or harvesting.

This soil is suitable for building site development. Septic tank absorption fields can function adequately. On sites for sewage lagoons, seepage and slope are limitations. Sufficiently compacting the bottom and berms of the lagoon helps to prevent seepage. Also, some leveling is needed.

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

8C2—Crider silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, well drained soil is mainly on the tops of ridges in the uplands. Individual areas are long and narrow and range from 20 to 100 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 7 inches thick. The subsoil to a depth of about 62 inches or more is firm silty clay loam. It is dark brown in the upper part, yellowish brown and mottled in the next part, and reddish brown and mottled in the lower part. In places bedrock is within a depth of 60 inches. In a few areas, the soil is not eroded and the surface soil is 12 or more inches thick.

Included with this soil in mapping are some scattered small areas of Bucklick soils, which have bedrock at a depth of 40 to 60 inches. Also included are some severely eroded areas where the plow layer is dark brown silty clay loam. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Crider soil. Available water capacity is high. Runoff is medium. Natural fertility also is medium, and the content of organic matter is moderate. The surface layer is friable and can be easily tilled in all areas, except for eroded ones. No restrictions affect root development.

Most areas of this soil are used for cultivated crops, pasture, or hay. Corn, soybeans, and wheat are the principal crops. They generally are grown in rotation with pasture or hay. A significant acreage has been developed for urban uses or for rural residential uses. A few tracts remain forested.

This soil is well suited to cultivated crops. About 10 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress in summer-grown crops during most years. Erosion is a severe hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay at least every other year. Grade-stabilization structures generally are needed if grassed waterways are established.

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

In most of the areas of native forest, selective cutting and stand improvement are needed. No major problems affect tree growth, planting, or harvesting.

This soil is suitable for building site development. Septic tank absorption fields can function adequately. On sites for sewage lagoons, seepage and slope are limitations. Sufficiently compacting the bottom and berms of the lagoon helps to prevent seepage. Also, some leveling is needed, even in the less sloping areas.

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

8D2—Crider silt loam, 9 to 14 percent slopes, eroded. This deep, well drained, strongly sloping soil is mainly on the upper side slopes. In places it occupies the entire side slope between a ridgetop and a drainageway. Most areas range from 10 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil extends to a depth of 60 inches or more. It is dark yellowish brown, firm silty clay loam in the upper part; brown silty clay loam in the next part; and yellowish red, mottled silty clay in the lower part. In places the lower part of the subsoil is brown silty clay loam. In a few areas, the soil is not eroded and the surface soil is 12 or more inches thick.

Included with this soil in mapping are some small areas of Bucklick soils, which have bedrock at a depth of 40 to 60 inches. These soils are mainly along small drainageways. Also included are some eroded areas

where the surface layer is dark yellowish brown silty clay loam. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Crider soil. Available water capacity is high. Runoff is rapid. Natural fertility is medium, and the content of organic matter is moderate. The surface layer is friable and can be easily tilled. No restrictions affect root development.

Most areas of this soil are used for pasture, hay, or cultivated crops. Corn, soybeans, and wheat are the principal crops. They generally are grown in rotation with hay and pasture. A small acreage is forested.

This soil is suited to cultivated crops only if the crops are grown on a limited basis. About 9 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress during the summer of most years. Because of rapid runoff following hard summer rains, the soil is better suited to drilled soybeans grown in rotation with cover crops than to corn. Erosion is a severe hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay during at least 3 out of every 4 years. Grade-stabilization structures may be needed if grassed waterways are established.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as orchardgrass and timothy; and to warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management concerns. Preparing a seedbed in a timely manner and on the contour helps to ensure a good ground cover. Measures that maintain fertility and control brush are needed.

A small acreage of this soil is native forest. Some abandoned areas of eroded farmland are reverting to forest, and a few tracts have been planted to pine. In most of the wooded areas, selective cutting and stand improvement are needed. No serious problems affect tree growth, planting, or harvesting.

If this soil is used for building site development or onsite waste disposal, the slope is a limitation. Land grading is needed. Buildings should be designed so that they conform to the natural slope of the land. Septic tank absorption fields can function adequately, but the distribution lines generally should be installed across the slope. The soil generally is unsuitable as a site for sewage lagoons because of the slope.

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

8E—Crider silt loam, 14 to 20 percent slopes. This very deep, moderately steep, well drained soil is on side slopes in the uplands. Most areas are on north-facing slopes. They range from 20 to 80 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsurface layer is yellowish brown, friable silt loam about 4 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is dark yellowish brown, friable silt loam. The lower part is dark brown and yellowish red, mottled, firm silty clay loam. In places it is brown silty clay loam.

Included with this soil in mapping are some scattered areas of Bucklick soils and some eroded areas where the surface layer is dark brown silty clay loam. Bucklick soils have bedrock at a depth of 40 to 60 inches. Also included, mainly on the lower slopes, are areas of a soil that has more sand in the subsoil than Crider soil and is underlain by sandstone bedrock. Included soils make up about 20 percent of the unit.

Permeability is moderate in the Crider soil. Available water capacity is high. Runoff is rapid. Natural fertility is medium, and the content of organic matter is moderate. The surface layer is friable and can be easily tilled in all areas, except for eroded ones. No restrictions affect root development.

Most areas of this soil are used for pasture or hay or remain forested. Some of the smoother slopes are used for cultivated crops. Corn, soybeans, and wheat are the principal crops. They are grown in rotation with pasture or hay.

This soil is suited to cultivated crops only if the crops are grown on a limited basis. About 9 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress during the summer of most years. Because of rapid runoff following hard summer rains, the soil is better suited to no-till drilled soybeans grown in a long rotation with cover crops than to corn. Erosion is a severe hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay during at least 3 out of every 4 years. Grade-stabilization structures may be needed if grassed waterways are established.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as orchardgrass and timothy; and to warm-season grasses, such as big

bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management concerns. Preparing a seedbed in a timely manner and on the contour helps to ensure a good ground cover. Measures that maintain fertility and control brush are needed.

A substantial acreage of this soil supports native trees, dominantly good-quality white oak. Some areas of abandoned farmland are reverting to forest, and a few such areas have been planted to pine. In many of the wooded areas, selective cutting and stand improvement are needed. Where timber is harvested, gully erosion is a hazard on logging roads and skid trails. It can be controlled by carefully selecting sites for the roads and trails and by building small check dams or water breaks at selected intervals. Reseeding may be needed after the trees are harvested. Operating equipment is hazardous because of the slope. Logging roads can be built on the contour. In the steepest areas, the logs should be yarded uphill to logging roads and skid trails.

If this soil is used for building site development or onsite waste disposal, the slope is a limitation. Land grading is needed. Buildings should be designed so that they conform to the natural slope of the land. Septic tank absorption fields can function adequately, but the distribution lines generally should be installed across the slope. The soil generally is unsuitable as a site for sewage lagoons because of the slope.

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

10F—Gasconade-Rock outcrop complex, 9 to 35 percent slopes. This map unit occurs as areas of a strongly sloping to steep, somewhat excessively drained, shallow Gasconade soil intricately mixed with areas of Rock outcrop. The unit is in glades on ridgetops and side slopes in the uplands. Individual areas range from 10 to 80 acres in size. They are about 70 percent Gasconade soil and 20 percent outcrops of dolomite. The Gasconade soil and Rock outcrop occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the Gasconade soil has a surface layer of very dark gray, firm flaggy silty clay loam about 6 inches thick. The subsoil is very dark brown, firm very flaggy silty clay about 9 inches thick. Hard dolomite bedrock is at a depth of about 15 inches. In places stones cover 1 to 3 percent of the surface.

Included with the Gasconade soil and Rock outcrop in mapping are some scattered areas where the slope is as much as 60 percent and some nearly vertical cliffs. Also included are some areas of the moderately deep Gatewood soils, mainly on the less sloping parts of the landscape. Included areas make up about 10 percent of the unit.

Permeability is moderately slow in the Gasconade soil. Available water capacity is very low. Runoff is rapid. The content of organic matter is moderate, and natural fertility is medium. Root development is severely limited by the bedrock within a depth of 20 inches, but the roots of some plants extend into crevices or fractures in the dolomite.

Most of the acreage is used as recreational areas and wildlife habitat. Most areas support scattered eastern redcedar and sparse stands of native grasses or stands of poor-quality mixed hardwoods. Some high-quality redcedar is harvested for posts and other purposes, but the trees grow slowly. Other hardwoods seldom reach marketable size or quality.

Some areas are pastured, but forage production is severely limited by the shallow root zone. Indiangrass, switchgrass, big bluestem, little bluestem, and sideoats grama are native grasses on this soil. Alternate year use or another means of severely restricting grazing can help to maintain the stands of grasses.

These glades are unique ecological areas. They support several kinds of wild flowers and other plants and provide habitat for rare species of reptiles and insects.

Because of the Rock outcrop and the limited depth to bedrock in the Gasconade soil, this unit generally is unsuitable for building site development and onsite waste disposal.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Gasconade soil is 2R. No woodland ordination symbol is assigned to the Rock outcrop.

12—Bremer silty clay loam. This very deep, nearly level, poorly drained soil is mainly on stream terraces along the lower reaches of the tributaries of the Missouri River and along cutoff stream meanders. It is subject to rare flooding of brief duration. Most areas range from 10 to 150 acres in size.

Typically, the surface layer is black, friable silty clay loam about 12 inches thick. The subsurface layer is very dark gray, firm silty clay loam about 12 inches thick. The subsoil is dark gray, mottled, firm silty clay loam about 30 inches thick. The substratum to a depth of about 60 inches is dark gray, firm silty clay loam. In places the surface layer is silt loam.

Included with this soil in mapping are scattered small areas of the somewhat poorly drained Auxvasse soils.

These soils have a surface soil that is silt loam and is thicker than that of the Bremer soil. They make up about 10 percent of the unit.

Permeability is moderately slow in the Bremer soil. Available water capacity is high. Runoff is slow. Natural fertility is medium, and the content of organic matter is high. The surface layer can be easily tilled only within a fairly narrow range of moisture content. It puddles easily if it is worked when wet. During extended wet periods, root development is somewhat restricted by a seasonal high water table at a depth of 1 to 2 feet in winter and spring. The shrink-swell potential is high in the subsoil.

Nearly all areas of this soil are used for cultivated crops, pasture, or hay. Corn, soybeans, and wheat are the principal crops. A few small areas remain forested.

This soil is better suited to soybeans than to corn because wetness delays planting in most years. About 10 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress during the summer of most years. The seasonal high water table and poor surface drainage are the main limitations. Land grading and shallow surface ditches can improve surface drainage. Fall plowing generally can improve tilth.

This soil is moderately suited to water-tolerant, shallow-rooted legumes, such as ladino clover and alsike clover, and to cool-season grasses, such as reed canarygrass. It is suited to warm-season grasses, such as switchgrass and big bluestem. The wetness and the flooding are the main management concerns. The flooding should be considered when a grazing system is designed. Maintaining stands of desirable species is difficult in depressional areas. A surface drainage system improves the suitability for the deeper rooted species.

The stands in the few small tracts of forest are dominated by water-tolerant species, such as pin oak, swamp white oak, green ash, and sycamore. No significant amount of tree planting has been done on this soil. The trees selected for planting should be those that can withstand wetness. They should be planted and harvested during dry periods. Reinforcement planting on ridges is needed because of the seedling mortality rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

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

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

13A—Auxvasse silt loam, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping, somewhat poorly drained soil is on stream terraces. It generally is subject to rare flooding of brief duration. Most areas range from 10 to 80 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 9 inches thick. The subsurface layer is brown, friable silt loam about 8 inches thick. The next 3 inches is dark yellowish brown silty clay. It has thick, brown silt coatings on peds and in cracks. The subsoil is about 20 inches thick. It is dark grayish brown, mottled, firm silty clay in the upper part and grayish brown, mottled silty clay loam in the lower part. The substratum to a depth of 62 inches or more is grayish brown, mottled, firm silt loam. In many eroded areas along the edges of terrace escarpments, the surface layer is silty clay loam.

Included with this soil in mapping are some scattered areas of Twomile soils, which have a dense, compact subsurface layer. These soils make up about 10 percent of the unit.

Permeability is very slow in the Auxvasse soil. Available water capacity is moderate. Runoff is slow. Natural fertility and the content of organic matter are low. The surface layer is friable and can be easily tilled. Root development is somewhat restricted below a depth of about 20 inches because of the content of clay in the subsoil. In most years the surface layer is saturated during early spring because of a perched water table at a depth of 1 to 2 feet. The shrink-swell potential is high in the subsoil.

Nearly all areas are used for cultivated crops, pasture, or hay. Corn, soybeans, grain sorghum, and wheat are the principal crops. This soil is better suited to soybeans and grain sorghum than to corn because wetness delays spring planting in most years. Land grading and shallow surface ditches can improve surface drainage. About 8 inches of water is available for plant growth in this soil. This is enough to avoid serious summer moisture stress in corn during most years if the crop is planted early in spring and high plant populations are avoided.

This soil is suited to most of the commonly grown legumes, such as ladino clover and lespedeza, to cool-season grasses, such as tall fescue and reed canarygrass; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. The species that can withstand wetness grow best. No serious problems affect the establishment of pasture plants.

A small acreage remains forested. Equipment should be operated only when the soil is dry or frozen. The seedling mortality rate can be reduced by planting

container-grown stock on ridges and by watering. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

The only areas of this soil that should be used for building site development and onsite waste disposal are those with no history of flooding. The shrink-swell potential and the wetness are limitations on building sites. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and floors and by backfilling with sand and gravel. Because of the wetness, the building should be constructed on raised, well compacted fill material and tile drains are needed around footings and foundations. The soil is suitable as a site for septic tank absorption fields because of the very slowly permeable subsoil, but properly designed sewage lagoons can function adequately.

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

14C—Hobson loam, 5 to 9 percent slopes. This very deep, moderately sloping, moderately well drained soil is on ridgetops and side slopes in the uplands. Most areas are long and narrow and range from 20 to 200 acres in size. Some extend for a mile or more.

Typically, the surface layer is dark brown, very friable loam about 4 inches thick. The subsurface layer is brown, friable loam about 4 inches thick. The upper part of the subsoil is dark brown and strong brown, firm clay loam. The lower part to a depth of about 60 inches or more is a fragipan of mixed brown and yellowish brown, mottled, firm, brittle loam. The fragipan has chert and sandstone fragments in the lower part. In places the surface layer is silt loam.

Included with this soil in mapping are some small areas of the moderately deep Lily and shallow Ramsey soils, generally at the head of drainageways. Also included are some eroded areas where the surface layer is strong brown clay loam. Included soils make up about 10 percent of the unit.

Permeability is moderate above the fragipan in the Hobson soil and slow in the pan. Available water capacity is low. Runoff is medium. Natural fertility and the content of organic matter are low. A perched water table is at a depth of 1.5 to 3.0 feet for brief periods during winter and early spring. The surface layer is friable and can be easily tilled. Root development is severely restricted by the fragipan below a depth of about 22 inches.

This soil is used primarily for pasture or hay, but many areas are used for cultivated crops, mainly wheat and grain sorghum. A large acreage remains forested.

The suitability of this soil for different crops depends on the needs of the crop for soil moisture. Less than 6 inches of water is available for plant growth in this soil. This is not enough to prevent serious moisture stress during the summer of most years. As a result, the soil is poorly suited to corn and soybeans. It is better suited to grain sorghum and small grain grown in rotation with hay and pasture. Erosion is a severe hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, a combination of terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay at least every other year. Grade-stabilization structures may be needed where grassed waterways are established. The cost effectiveness of terraces and other mechanical erosion-control practices is questionable on this soil.

This soil is well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem, Caucasian bluestem, and indiangrass. The rooting depth is only moderate, and droughtiness is a problem during much of the year. Erosion control is needed in areas where the pasture is tilled and newly seeded. Timely tillage and a quickly established ground cover are necessary to prevent excessive soil loss.

A large acreage of this soil is native forest. Some tracts have been planted to pine. The fragipan restricts the rooting depth and thus increases the likelihood of windthrow damage and seedling mortality. The windthrow hazard can be reduced by block planting. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Reinforcement planting or replanting may be needed because of the seedling mortality rate.

If this soil is used for building site development, the wetness is a limitation. It can be reduced by installing tile drains around footings and foundations. Septic tank absorption fields cannot function adequately because of the wetness and the slowly permeable fragipan. Properly designed sewage lagoons can function adequately. The slope is a limitation, but the site generally can be leveled.

The land capability classification is IIIe. The woodland ordination symbol is 2D.

14D—Hobson loam, 9 to 14 percent slopes. This very deep, strongly sloping, moderately well drained soil is on convex side slopes in the uplands. Most areas range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 2 inches thick. The subsurface layer is brown, friable loam about 3 inches thick. The upper part of the subsoil is strong brown, firm clay loam. Below this to a depth of more than 60 inches is a mottled brown and grayish brown, hard, compact fragipan. The fragipan is clay loam in the upper part, sandy clay loam in the next part, and sandy loam in the lower part. In places hard sandstone bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are areas of the moderately deep Lily and shallow Ramsey soils, mainly along drainageways. Also included are some eroded areas where the surface layer is strong brown clay loam. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate above the fragipan in the Hobson soil and slow in the pan. Available water capacity is low. Runoff is rapid in cultivated areas. Natural fertility and the content of organic matter are low. A perched water table is at a depth of 1.5 to 3.0 feet for short periods during winter and early spring. The surface layer is friable and can be easily tilled. Root development is severely restricted by the fragipan below a depth of about 23 inches.

This soil is used primarily for pasture or hay. A few areas are used for cultivated crops. A large acreage remains forested.

This soil is suited to cultivated crops only if the crops are grown on a limited basis. Less than 6 inches of water is available for plant growth in this soil. This is not enough to prevent serious moisture stress during the summer of most years. Rapid runoff during periods of heavy rainfall increases the likelihood of moisture stress. Erosion is a hazard. It can be controlled by a cropping sequence that includes several years of close-grown pasture or hay and by a system of conservation tillage that leaves a protective cover of crop residue on the surface throughout the year. A permanent plant cover is the best means of controlling erosion.

This soil is well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and indiangrass. The rooting depth is only moderate, and droughtiness is a problem during much of the year. Erosion control is needed in areas where the pasture is tilled and newly seeded. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

A large acreage of this soil is native forest. Also, a substantial acreage of abandoned farmland is reverting to forest. Some tracts have been planted to pine. In most of the wooded areas, selective cutting and stand improvement are needed. The fragipan restricts the rooting depth and thus increases the likelihood of windthrow damage and seedling mortality. The windthrow hazard can be reduced by block planting. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Reinforcement planting or replanting may be needed because of the seedling mortality rate.

If this soil is used for building site development, the wetness and the slope are limitations. The wetness can be reduced by installing tile drains around footings and foundations. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. The soil generally is unsuitable as a site for septic tank absorption fields because of the wetness and the slowly permeable fragipan. Properly designed sewage lagoons can function adequately if the site is leveled.

The land capability classification is IVe. The woodland ordination symbol is 2D.

15—Gladden-Midco complex. These very deep, nearly level soils are on small flood plains along streams in the southern part of the county. They are occasionally flooded for brief periods. The Gladden soil is well drained, and the Midco soil is somewhat excessively drained. Individual areas are as much as about 750 feet wide and a mile or more long. They are about 65 percent Gladden soil and 20 percent Midco soil. The two soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Gladden soil is brown, very friable silt loam about 12 inches thick. The subsoil is dark brown, friable silt loam about 29 inches thick. The substratum to a depth of 60 inches is brown and dark yellowish brown, friable very cherty sandy loam.

Typically, the surface layer of the Midco soil is dark brown, friable cherty sandy loam about 7 inches thick. The substratum to a depth of 60 inches or more is brown and dark brown, very friable extremely cherty loam.

Included with these soils in mapping are some areas of the deep, silty Haymond soils on the wider flood plains and some areas of the poorly drained Twomile

soils on stream terraces. Included soils make up about 15 percent of the unit.

Permeability is moderate in the upper part of the Gladden soil and rapid in the lower part. It is moderately rapid in the Midco soil. Available water capacity is moderate in the Gladden soil and low in the Midco soil. Natural fertility is low in both soils. The content of organic matter is moderate in the Gladden soil and low in the Midco soil. The surface layer of the Gladden soil is friable and can be easily tilled. The chert fragments in the surface layer of the Midco soil interfere with tillage. No limitations affect root development in either soil.

Most areas of these soils have been cleared of trees and are used for pasture or hay. Some areas are used for small grain or grain sorghum. A considerable acreage remains forested.

In areas that are large enough for the use of farm machinery, these soils are suited to cultivated crops. Only about 4 inches of water is available for plant growth in the Midco soil and 7 inches in the Gladden soil. As a result, most areas are better suited to small grain and grain sorghum than to corn or soybeans. Most flooding occurs before the spring growing season. It can delay planting and damage crops in some years.

These soils are well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as tall fescue and reed canarygrass; and to warm-season grasses, such as indiangrass, big bluestem, and switchgrass. Droughtiness and flooding are the main problems. The species that can withstand the flooding should be selected for planting.

The acreage of native forest is mainly on the upstream reaches of the narrow bottom land. A few tracts have been planted to walnut trees. In many of the wooded areas, selective cutting and stand improvement are needed. Plant competition is a management concern. It can be controlled by cutting and by treating the stumps of woody plants with herbicide. Reinforcement planting or replanting may be needed because of the seedling mortality rate on the Midco soil.

These soils are generally unsuitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIIw. The woodland ordination symbol assigned to the Gladden soil is 4A, and that assigned to the Midco soil is 3F.

16—Blake-Waldron complex. These very deep, nearly level, somewhat poorly drained soils are on the flood plains along the Missouri River. They are protected by levees but are subject to rare flooding because of levee breaks. The Blake soil generally is slightly higher on the landscape than the Waldron soil. Individual areas are as much as hundreds of acres in size. They are 50 to 60 percent Blake soil and 30 to 40 percent Waldron soil. The two soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Blake soil is very dark grayish brown, friable silty clay loam about 8 inches thick. The substratum to a depth of 60 inches is dark grayish brown, firm silty clay loam and dark grayish brown, friable silt loam that has thin strata of brown and dark gray, firm silty clay.

Typically, the surface layer of the Waldron soil is very dark grayish brown silty clay loam about 6 inches thick. The substratum to a depth of 60 inches occurs as strata of very dark grayish brown and dark grayish brown silty clay and silty clay loam.

Included with these soils in mapping are areas of the well drained Haynie soils on low natural levees. These included soils make up about 10 percent of the unit.

Permeability is moderate in the Blake soil and slow in the Waldron soil. Available water capacity is very high in the Blake soil and high in the Waldron soil. Runoff is slow on both soils. Natural fertility is high, and the content of organic matter is moderate. Wetness and a high content of clay, especially in the Waldron soil, somewhat hinder tillage. Root development is somewhat restricted in the Waldron soil by poor aeration. During winter and spring, a seasonal high water table is at a depth of 2 to 4 feet in the Blake soil and 1 to 3 feet in the Waldron soil. The shrink-swell potential is moderate in the Blake soil and high in the Waldron soil.

Most areas are used for corn or soybeans. Wheat is grown in some areas. It usually is double cropped with soybeans. These soils are well suited to cultivated crops. About 12 inches of water is available for plant growth in the Blake soil and 9 inches in the Waldron soil. These amounts are enough to prevent serious moisture stress during the summer of all but the driest years. The soils should be tilled during periods of optimum moisture. Land grading and shallow surface ditches can improve surface drainage. Plowing in the fall generally improves tilth in the spring.

If trees are grown on the Waldron soil, seedling mortality and wetness are limitations. Reinforcement planting may be necessary because of the seedling mortality rate. Planting and harvesting equipment should be used only during dry periods.

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

The land capability classification is IIw. The woodland ordination symbol assigned to the Waldron soil is 11C, and that assigned to the Blake soil is 12A.

17—Hodge-Blake complex. These very deep, nearly level soils are on flood plains adjacent to the Missouri River. They are not protected by levees and are frequently flooded. The somewhat excessively drained Hodge soil is mainly on natural levees, and the somewhat poorly drained Blake soil is in narrow swales and in broader areas of intermediate elevation. Individual areas range from 20 to 300 acres in size. They are 50 to 60 percent Hodge soil and 30 to 40 percent Blake soil. The two soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Hodge soil is brown fine sand about 10 inches thick. The substratum to a depth of 60 inches or more is brown, loose fine sand that has thin strata of finer textured material.

Typically, the surface layer of the Blake soil is very dark grayish brown silty clay loam about 10 inches thick. The substratum is brown. The upper part is silty clay loam, the next part is very fine sandy loam, and the lower part to a depth of 60 inches is silt loam.

Included with these soils in mapping are long, narrow sloughs where the water level fluctuates and some recent sandbars in areas behind rock dikes or jetties. Also included are areas of Waldron soils in the lowest swales. Included areas make up about 15 percent of the unit.

Permeability is rapid in the Hodge soil and moderate in the Blake soil. Available water capacity is low in the Hodge soil and very high in the Blake soil. Runoff is slow on both soils. Natural fertility is low in the Hodge soil and high in the Blake soil. The content of organic matter is low in the Hodge soil and moderate in the Blake soil. The Blake soil has a seasonal high water table at a depth of 2 to 4 feet during most winter and spring months. It has a moderate shrink-swell potential.

Nearly all areas of these soils are used for timber and for wildlife habitat. Most of the timber stands are unmanaged. A few areas have been cleared of trees and are used for cultivated crops, but the frequent flooding is a severe hazard in cultivated areas.

Trees grow rapidly on these soils. The native species include eastern cottonwood, silver maple, ash, boxelder, and sycamore. Thinning is needed in most of the stands. Seedling mortality is moderate on the Hodge soil. Some replanting or reinforcement planting may be necessary.

These soils generally are unsuitable for building site development and onsite waste disposal because of the frequent flooding.

The land capability classification is Vw. The woodland ordination symbol assigned to the Hodge soil is 11S, and that assigned to the Blake soil is 12A.

19—Haynie-Waldron complex. These very deep, nearly level soils are on the flood plains along the Missouri River. They are protected by levees but are subject to rare flooding. The Haynie soil is well drained, and the Waldron soil is somewhat poorly drained. Individual areas range from 20 to several hundred acres in size. They are about 50 to 60 percent Haynie soil and 20 to 30 percent Waldron soil. The two soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Haynie soil is very dark grayish brown, very friable very fine sandy loam about 8 inches thick. The upper part of the substratum is stratified dark grayish brown and dark brown, very friable silt loam. The lower part to a depth of 60 inches or more is dark grayish brown, very friable very fine sandy loam.

Typically, the surface layer of the Waldron soil is very dark grayish brown, firm silty clay about 7 inches thick. The substratum to a depth of 60 inches occurs as strata of very dark grayish brown, dark grayish brown, and dark gray, firm silty clay loam and silty clay.

Included with these soils in mapping are scattered areas of the somewhat poorly drained Blake soils. These included soils make up about 15 percent of the unit.

Permeability is moderate in the Haynie soil and slow in the Waldron soil. Available water capacity is high in both soils. Runoff is slow. Natural fertility is high, and the content of organic matter is moderate. The surface layer of the Haynie soil is friable and can be easily tilled. No restrictions affect root development in this soil. Root development in the Waldron soil is somewhat restricted by poor aeration. The Waldron soil has a seasonal high water table at a depth of 1 to 3 feet in winter and spring. The shrink-swell potential is low in the Haynie soil and high in the Waldron soil.

Most areas are used for corn or soybeans. Wheat is grown in some areas. It generally is double cropped with soybeans. These soils are well suited to cultivated crops. About 11 inches of water is available for plant growth in the Haynie soil and 9 inches in the Waldron soil. These amounts are enough to prevent serious

moisture stress during the summer of all but the driest years. Wetness and a high content of clay somewhat hinder tillage of the Waldron soil. This soil generally is fall plowed along with the Haynie soil. Plowing in the fall improves tilth in the spring. A surface drainage system is needed in some areas of the Waldron soil in swales.

If trees are grown on the Waldron soil, seedling mortality and wetness are management concerns. Reinforcement planting may be necessary because of the seedling mortality rate. Planting and harvesting equipment should be used only during dry periods.

These soils generally are unsuitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIw. The woodland ordination symbol assigned to the Haynie soil is 11A, and that assigned to the Waldron soil is 11C.

20—Hodge-Haynie complex. These very deep, nearly level soils are on flood plains along the Missouri River. They are protected by levees but are subject to rare flooding. They have received sandy overwash as the result of levee breaks during major floods. The Hodge soil is somewhat excessively drained, and the Haynie soil is well drained. Individual areas generally are 20 to 200 acres in size. They are about 50 to 60 percent Hodge soil and 20 to 30 percent Haynie soil. The two soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Hodge soil is dark brown, loose fine sand about 6 inches thick. The substratum to a depth of 60 inches or more is brown, loose fine sand that has thin strata of finer or coarser textured material.

Typically, the surface layer of the Haynie soil is very dark grayish brown, very friable very fine sandy loam about 10 inches thick. The upper part of the substratum is stratified dark grayish brown and dark brown, very friable silt loam. The lower part to a depth of 60 inches or more is dark grayish brown, very friable very fine sandy loam.

Included with these soils in mapping are areas where 20 to 40 inches of loamy fine sand overlies finer textured material. Also included are areas of the poorly drained Waldron soils in narrow swales. Included soils make up about 20 to 25 percent of the unit.

Permeability is rapid in the Hodge soil and moderate in the Haynie soil. Available water capacity is low in the Hodge soil and high in the Haynie soil. Runoff is slow on both soils. Natural fertility is low in the Hodge soil and high in the Haynie soil. The content of organic matter is low in the Hodge soil and moderate in the Haynie soil. The surface layer of both soils is friable and can be easily tilled. No restrictions affect root development.

Most areas are used for cultivated crops, but a substantial acreage is used for alfalfa. These soils are best suited to alfalfa and small grain. Only about 5 inches of water is available for plant growth in the sandy Hodge soil. This is generally insufficient for corn and soybeans. About 11 inches of water is available in the Haynie soil. This soil is well suited to all of the crops commonly grown in the county, but it generally occurs as areas that are too small or too intricately mixed to be managed separately from the droughty Hodge soil.

If trees are planted on this unit, seedling mortality on the Hodge soil is the only major management concern. Reinforcement planting may be needed.

These soils generally are unsuitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIIs. The woodland ordination symbol assigned to the Hodge soil is 11S, and that assigned to the Haynie soil is 11A.

22—Waldron-Booker silty clays. These very deep, nearly level soils are on the flood plains along the Missouri River. They are in long, narrow swales and broad depressional areas, nearly all of which have been drained. The soils are protected by levees but are subject to rare flooding because of levee breaks or overflow from local tributaries. The Booker soil is very poorly drained and is subject to ponding. The Waldron soil is somewhat poorly drained and is slightly higher on the landscape than the Booker soil. Individual areas range from 10 to 200 acres in size. They are about 60 percent Waldron soil and 30 percent Booker soil. The two soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Waldron soil is very dark grayish brown, firm silty clay about 9 inches thick. The substratum extends to a depth of 60 inches or more. It is firm. The upper part is very dark grayish brown silty clay loam, and the lower part is dark gray and dark grayish brown, mottled silty clay.

Typically, the surface layer of the Booker soil is very dark grayish brown, firm silty clay about 8 inches thick. The subsoil is about 28 inches of very dark grayish brown, firm silty clay and very dark gray, mottled, firm clay. The substratum to a depth of 60 inches or more is dark gray, mottled, firm clay.

Included with these soils in mapping are scattered areas of Blake soils. These included soils are less

clayey than the Waldron and Booker soils. They make up about 10 percent of the unit.

Permeability is slow in the Waldron soil and very slow in the Booker soil. Available water capacity and natural fertility are high in the Waldron soil and moderate in the Booker soil. The content of organic matter is moderate in both soils. Root development is somewhat restricted by a high content of clay, especially in the Booker soil. During winter and spring, the Waldron soil has a seasonal high water table at a depth of 1.0 to 3.0 feet and the Booker soil has one 0.5 foot above the surface to 1.0 foot below. The shrink-swell potential is high in the Waldron soil and very high in the Booker soil.

Nearly all areas are used for soybeans or corn. Wheat is grown on a very small acreage. It generally is double cropped with soybeans. These soils are better suited to soybeans than to corn because wetness delays planting in most years. About 9 inches of water is available for plant growth in the Waldron soil and 8 inches in the Booker soil. Some degree of moisture stress is evident during very dry summers, especially on the Booker soil. Tilling these soils is difficult because of the wetness and the high content of clay. Plowing in the fall generally improves tilth in the spring. Seepage is a hazard during prolonged wet periods. It commonly delays planting.

If trees are grown on these soils, the wetness and the high content of clay limit the use of equipment and can result in seedling mortality and windthrow damage. Equipment should be operated only when the soils are dry or frozen. Ridging the soil and then planting on the ridges increase the seedling survival rate. Also, reinforcement planting or replanting may be necessary. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

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

The land capability classification is IIIw. The woodland ordination symbol assigned to the Waldron soil is 11C, and that assigned to the Booker soil is 6W.

23C2—Winfield silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, moderately well drained soil is mainly on the tops of ridges in the uplands. Most of the ridgetops are narrow and winding and extend for several miles.

Typically, the surface layer is brown, very friable silt loam about 5 inches thick. The subsoil is about 43 inches thick. It is dark yellowish brown, friable silt loam in the upper part; dark yellowish brown, firm silty clay loam in the next part; and dark yellowish brown and dark brown, mottled, firm silty clay loam in the lower part. The substratum to a depth of more than 60 inches is dark brown, mottled, friable silt loam. In some uneroded areas the surface layer is 10 or more inches thick.

Included with this soil in mapping are scattered small areas of Union soils. These soils have a fragipan and contain more clay in the subsoil than the Winfield soil. Also included are small severely eroded areas where the plow layer is yellowish brown silty clay loam. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Winfield soil. Available water capacity is high. Runoff is medium. Natural fertility also is medium, and the content of organic matter is low. A perched water table is at a depth of 2.5 to 4.0 feet during most winter and spring months. The surface layer is friable and can be easily tilled. No restrictions affect root development. The shrink-swell potential is moderate in the subsoil.

Much of the acreage of this soil is developed for urban uses or for rural residential uses or is idle land that is set aside for such development. Many areas are used for pasture, and some are used for hay. A small acreage is cultivated, and a few areas are forested.

This soil is suited to cultivated crops. About 10 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress in summer-grown crops during most years. Erosion is a severe hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay at least every other year. Grade-stabilization structures may be needed where grassed waterways are established.

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

A few areas of this soil support native trees. A few small tracts have been planted to pine. In most of the wooded areas, selective cutting and stand improvement are needed. No major problems affect tree growth, planting, or harvesting.

If this soil is used for building site development, the shrink-swell potential and the wetness are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and footings and by backfilling with sand or gravel. The wetness can be reduced by installing tile drains around footings and foundations. Septic tank absorption fields can function adequately if curtain drains are installed to lower the water table and the absorption area is large enough to compensate for the moderate permeability. Properly designed sewage lagoons can function adequately in the less sloping areas if they are compacted, so that seepage is controlled.

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

23D2—Winfield silt loam, 9 to 14 percent slopes, eroded. This very deep, strongly sloping, moderately well drained soil is on side slopes and foot slopes in the uplands. Most areas range from about 10 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 40 inches thick. It is dark brown, friable silt loam in the upper part; dark brown, firm silty clay loam in the next part; and dark yellowish brown, mottled, firm silty clay loam in the lower part. The substratum to a depth of more than 60 inches is dark yellowish brown, mottled, friable silt loam. In some uneroded areas the surface layer is 10 or more inches thick.

Included with this soil in mapping are small areas of the well drained Bucklick soils along drainageways. Also included are small severely eroded areas where the plow layer is silty clay loam. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Winfield soil. Available water capacity is high. Runoff is medium. Natural fertility also is medium, and the content of organic matter is low. A perched water table is at a depth of 2.5 to 4.0 feet during most winter and spring months. The surface layer is friable and can be easily tilled in all areas, except for eroded ones. No restrictions affect root development. The shrink-swell potential is moderate in the subsoil.

Most areas of this soil are used for pasture or hay. Some have been developed as sites for houses or commercial buildings. A few areas are used for cultivated crops. The acreage of native forest is insignificant.

This soil is suited to cultivated crops. About 9 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress in summer-grown crops during most years. Soil moisture is lost as runoff during periods of heavy rainfall in summer. Erosion is a severe hazard. It can be controlled by no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay during at least 3 out of every 4 years. Grade-stabilization structures generally are needed if grassed waterways are established.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as orchardgrass and timothy; and to warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management concerns. Preparing a seedbed in a timely manner and on the contour helps to ensure a good ground cover. Measures that maintain fertility and control brush are needed.

A few small tracts have been planted to pine, and some areas support shade trees and ornamental plantings. No serious problems affect tree planting or harvesting.

If this soil is used for building site development, the shrink-swell potential, the wetness, and the slope are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in basement walls and footings and by backfilling with sand and gravel. The wetness can be reduced by installing tile drains around footings and foundations. The site can be leveled by grading, or the building can be designed so that it conforms to the natural slope of the land. Septic tank absorption fields can function adequately if curtain drains are installed to lower the water table and the absorption area is large enough to compensate for the moderate permeability. The soil generally is unsuitable as a site for sewage lagoons because of the slope.

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

24E—Gatewood cherty silt loam, 14 to 20 percent slopes. This moderately deep, moderately well drained, moderately steep soil generally is on south-facing side slopes in the uplands. Individual areas generally range from 5 to 50 acres in size.

Typically, the surface layer is brown, very friable cherty silt loam about 3 inches thick. The subsurface layer is brown, friable cherty silt loam about 6 inches thick. The subsoil is dark brown, mottled, firm clay

about 15 inches thick. The substratum is dark yellowish brown, firm clay about 5 inches thick. Hard dolomite bedrock is at a depth of about 29 inches. In places the subsoil is red clay.

Included with this soil in mapping are scattered small areas of the shallow Gasconade soils and some areas of the deep Beemont soils in the higher landscape positions. Also included are small areas of the deep, well drained Bucklick soils on the lower side slopes between small drainageways. Included soils make up about 15 percent of the unit.

Permeability is slow in the Gatewood soil. Available water capacity is low. Runoff is rapid. Natural fertility and the content of organic matter are low. Root development is restricted by the clayey subsoil and by the depth to bedrock. The rock fragments hinder tillage. The shrink-swell potential is high in the subsoil.

Most areas of this soil remain native forest. Some areas have been cleared of trees and are used for pasture, and some wooded areas are pastured along with adjacent areas of other soils.

Because of the slope, the rock fragments, and the low available water capacity, this soil is unsuitable for cultivated crops. It is suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue and reed canarygrass, and to warm-season grasses, such as big bluestem, Caucasian bluestem, and indiangrass. Shallow-rooted species that can withstand droughtiness should be selected for planting. Careful control of grazing is necessary to maintain a good cover of legumes and warm-season grasses. The chert fragments hinder tillage, and erosion is a serious hazard when a pasture is seeded. Timely tillage and a quickly established ground cover are necessary to prevent excessive soil loss.

In most areas this soil supports mixed stands of native hardwoods. It generally is unsuited to hardwoods of commercial quality. These hardwoods grow slowly on this soil. Most develop defects before maturity. A few areas have been planted to pine. The hazard of erosion and the equipment limitation are problems on the steeper slopes. Logging roads should be built on the contour. In some areas reseeding is needed to control erosion after the trees are harvested.

This soil generally is unsuited to building site development and onsite waste disposal because the slope, the depth to bedrock, and the shrink-swell potential.

The land capability classification is VIIs. The woodland ordination symbol is 2R.

25E—Beemont cherty silt loam, 9 to 20 percent slopes. This deep, strongly sloping and moderately steep, moderately well drained soil is on the upper side slopes in the uplands. Most areas range from 10 to 200 acres in size.

Typically, the surface layer is very dark grayish brown, very friable cherty silt loam about 2 inches thick. The subsurface layer is yellowish brown and light yellowish brown, friable cherty and very cherty silt loam about 15 inches thick. The subsoil is about 35 inches thick. It is firm. It is yellowish red clay in the upper part; yellowish brown, mottled clay in the next part; and mottled dark yellowish brown and grayish brown cherty clay in the lower part. Fractured sandstone bedrock is at a depth of about 52 inches. In many small areas the surface layer is silt loam.

Included with this soil in mapping are some small areas of Union soils, mainly on the tapering end of ridges between drainageways. These soils have a fragipan. Also included are a few areas where sandstone boulders cover 1 to 2 percent of the surface. Included areas make up about 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Beemont soil and very slow in the lower part. Available water capacity is low. Runoff is rapid. Natural fertility is medium, and the content of organic matter is moderately low. The chert fragments and scattered sandstone boulders hinder tillage. Root development is restricted by the clayey subsoil. The shrink-swell potential is high in the subsoil.

Most areas of this soil support mixed stands of native hardwoods. Timber quality and species composition vary from area to area. North-facing slopes generally support fair- or good-quality white oak. On many of these slopes, selective cutting and stand improvement are needed. South-facing slopes, where the surface layer is cherty, support low-value stands, dominantly of post oak and black oak. A few cleared tracts have been planted to pine. If trees are planted, seedling mortality can be severe and reinforcement planting may be needed. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

Because of the slope, the rock fragments, and droughtiness, this soil is unsuited to cultivated crops. It is suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue and reed canarygrass; and to warm-season grasses, such as big bluestem, Caucasian bluestem, and indiangrass. Establishing a pasture is difficult because of the chert fragments and scattered boulders. Careful control of grazing is needed to maintain a good cover of legumes

and warm-season grasses. Erosion control is needed when a pasture is seeded.

This soil generally is unsuitable for building site development and onsite waste disposal because the shrink-swell potential and the slope are severe limitations.

The land capability classification is VIIs. The woodland ordination symbol is 2C.

29F—Menfro-Bardley silt loams, 20 to 50 percent slopes. These well drained soils are on side slopes in the northeastern part of the county. The very deep, steep Menfro soil commonly is on north-facing slopes. The moderately deep, steep and very steep Bardley soil is on both north- and south-facing slopes. Most areas occur as continuous bands as much as hundreds of acres in size. They are 45 to 60 percent Menfro soil and 25 to 35 percent Bardley soil. The two soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Menfro soil is friable silt loam about 10 inches thick. It is very dark grayish brown in the upper part and brown in the lower part. The subsoil is about 35 inches thick. It is dark brown. It is friable silt loam in the upper part and firm silty clay loam in the lower part. The substratum to a depth of 60 inches is brown, friable silt loam.

Typically, the surface soil of the Bardley soil is very dark grayish brown and yellowish brown, friable silt loam about 8 inches thick. The subsoil is firm clay about 22 inches thick. It is yellowish red in the upper part and strong brown in the lower part. Hard limestone bedrock is at a depth of about 30 inches.

Included with these soils in mapping are scattered small areas of the shallow Gasconade soils and the cherty Goss soils and areas where the slope is more than 35 percent. Also included are long, narrow areas of the silty Haymond and cherty Cedargap soils along small streams. Included soils make up about 20 percent of the unit.

Permeability is moderate in the Menfro and Bardley soils. Available water capacity is high in the Menfro soil and low in the Bardley soil. Runoff is rapid on both soils. Natural fertility is medium in the Menfro soil and low in the Bardley soil. The content of organic matter is moderately low in the Menfro soil and low in the Bardley soil. Root development is affected by no restrictions in the Menfro soil, but it is limited by the bedrock at a depth of 20 to 40 inches in the Bardley soil.

Most areas are used as native forest. Some of the less steep foot slopes have been cleared of trees and are used as pasture. Because of the slope and a severe hazard of erosion, these soils are unsuitable for cultivated crops. The suitability for pasture is limited by the slope and by the intricate pattern of dissection characteristic of the landscape.

The Menfro soil supports good or excellent timber stands dominated by high-quality white oak and red oak. In many of these stands, selective cutting and stand improvement are needed. Chinkapin oak, black oak, and eastern redcedar are the principal species on the Bardley soil. Trees grow more slowly on this soil than on the Menfro soil. A few small cleared areas have been planted to pine. No serious problems affect hand planting of trees. Windthrow is a hazard on the Bardley soil. This hazard can be reduced by block planting. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

When trees are harvested, the slope limits the use of equipment and erosion is a hazard. Sites for logging roads and skid trails should be carefully selected, and water breaks are needed at selected intervals. Reseeding of disturbed areas may be necessary. In the steepest areas, the logs should be yarded to the logging roads and skid trails.

Because of the slope, these soils generally are unsuitable for building site development and onsite waste disposal.

The land capability classification is VIIe. The woodland ordination symbol assigned to the Menfro soil is 3R, and that assigned to the Bardley soil is 2R.

31—Pits-Udorthents complex. This map unit consists of abandoned gravel pits and the adjacent strips of alluvial material that was excavated when the beds of gravel were exposed. Nearly all areas are on the flood plain along the Meramec River, near Pacific.

Pits make up about 50 percent of the unit. Most are filled with water. The water level in the pits fluctuates with the water level in the river.

Udorthents make up about 45 percent of the unit. They consist of silty and sandy alluvial material piled in long, narrow strips. These strips project from the flood plain into the water-filled pits, creating a system of long, mainly interconnected pools. Most areas support a dense cover of vegetation. Willow, sycamore, soft maple, elm, and boxelder are the major tree species. Open areas have a dense cover of grasses and forbs.

Included in this unit in mapping are areas of Haymond and Twomile soils on remnants of the original flood plain. Also included are areas of gravelly stream wash next to the river and some areas on river bars

where gravel is still being removed. Included areas make up about 5 percent of the unit.

This unit is used for recreational purposes and as habitat for fish and wildlife. It includes the Catawisa Wildlife Area, acquired by the Missouri Department of Conservation.

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

32—Pits, quarries. This map unit occurs as areas from which limestone, dolomite, and sandstone have been quarried. The areas typically are 4 to 10 acres in size. The quarries include the areas that are being excavated and the surrounding areas used for stockpiling, quarrying activities, and equipment. Most of the quarries are on steep, south-facing valley slopes where bedrock is exposed or is close to the surface. Some of the larger clay mines in the county are in areas of this unit. Refractory clays have been removed from these mines.

Included in this unit in mapping are borrow areas from which surficial material has been stripped for use in highway construction.

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

36F—Bardley cherty silt loam, 20 to 50 percent slopes. This moderately deep, steep and very steep, well drained soil is on the rough, wooded side slopes along the Meramec River and some tributaries in the south-central part of the county. Most areas are continuous over long distances and range to several hundred acres in size.

Typically, the surface layer is very dark grayish brown, very friable cherty silt loam about 2 inches thick. The subsurface layer is light yellowish brown, very friable cherty silt loam about 5 inches thick. The subsoil is about 26 inches thick. It is yellowish red, firm clay in the upper part; red, firm clay in the next part; and yellowish red, firm cherty clay in the lower part. Hard dolomite bedrock is at a depth of about 33 inches. In some places the depth to bedrock is 40 to 60 inches. In other places it is less than 20 inches.

Included with this soil in mapping are scattered areas of the deep Goss soils, which are cherty throughout. These soils make up about 10 percent of the unit.

Permeability is moderate in the Bardley soil. Available water capacity is low. Runoff is rapid. Natural fertility is medium, and the content of organic matter is low.

Nearly all areas are forested, except for some glade areas and a few small clearings. A few cleared areas have been planted to pine. Because of the slope and the hazard of erosion, this soil generally is unsuitable for cultivation. The timber stands generally are of poor quality. The good-quality stands are on the deeper included soils.

Because of the slope, the equipment limitation and the hazard of erosion on logging roads and skid trails are management concerns when timber is harvested. Sites for the roads and trails should be carefully selected. Reseeding may be needed after the trees are harvested. Operating equipment is hazardous on these slopes. In the steepest areas, the logs should be yarded to the logging roads and skid trails. Seedling mortality is moderate on south-facing slopes. Reinforcement planting may be needed. Windthrow is a hazard. This hazard can be reduced by block planting. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is generally unsuitable for building site development and onsite waste disposal because of the slope and the depth to bedrock.

The land capability classification is VIIe. The woodland ordination symbol is 2R.

38A—Haymond-Riverwash complex, 0 to 3 percent slopes. This map unit occurs as areas of a very deep, nearly level and very gently sloping, well drained Haymond soil intricately mixed with areas of Riverwash. The unit is in low areas along the major streams in the county. It is frequently flooded for brief periods. The landscape is dissected in a parallel pattern of closely spaced swales and sloughs. The Haymond soil is mainly in the higher areas between the swales. Individual areas generally range from 5 to 25 acres in size. They are about 40 percent Haymond soil and 35 percent Riverwash. The Haymond soil and the Riverwash occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Haymond soil is brown, very friable silt loam about 4 inches thick. The substratum to a depth of 60 inches or more is brown, friable silt loam.

The Riverwash occurs as recent deposits of sand, gravel, or a mixture of both on bars extending to the edge of the water.

Included in this unit in mapping are scattered small areas of the loamy Pope and cherty Midco soils and areas of water. Included areas make up about 25 percent of the unit.

Permeability is moderate in the Haymond soil, and available water capacity is high. Natural fertility is medium, and the content of organic matter is moderate.

Because of the frequent flooding and the intricate pattern of swales and sloughs, farming this unit is difficult. The Haymond soil is forested with stands of soft maple, sycamore, boxelder, and elm. The trees grow rapidly. Most of the stands are unmanaged. Stand improvement and selective cutting generally are needed. No major problems affect planting or harvesting.

The Riverwash generally is bare but has scattered clumps of willows, grasses, and forbs. It is a source of sand and gravel. It provides overnight camping sites for canoeists and other boaters on the larger streams.

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

39—Haymond silt loam. This very deep, nearly level, well drained soil is on flood plains along streams that flow from the Ozark highlands. It is occasionally flooded for brief periods, mainly in winter and early spring. Individual areas range from about 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 10 inches thick. The substratum to a depth of 60 inches or more is brown, friable silt loam. In some areas the upper part of the substratum is mottled. In other areas the substratum is sandy loam below a depth of 40 inches.

Included with this soil in mapping are some small areas of the loamy Pope soils near streambanks. These soils make up about 10 percent of the unit.

Permeability is moderate in the Haymond soil. Available water capacity is very high. Runoff is slow. Natural fertility is medium, and the content of organic matter is moderate. The surface layer is friable and can be easily tilled. No restrictions affect root development.

Most areas of this soil are used for cultivated crops, mainly corn, soybeans, and wheat. Some areas are used for pasture or hay, and some small areas remain forested.

This soil is well suited to cultivated crops. Flooding is a hazard. It seldom damages crops, however, and the damage caused by floodwater is small. Although major floods are rare, serious scouring losses can occur during these floods in conventionally tilled areas used for row crops. As a result, minimum tillage or no-till planting may be needed.

More than 12 inches of water is available for plant growth in this soil. This is enough to prevent moisture stress in summer-grown crops during all but the driest years. Because of the repeated use of moldboard plows and, more recently, the use of heavy farm equipment, traffic pans have formed. These are compacted layers below the plow layer. They restrict the movement of air and water and reduce the amount of water that is available to plants. They can be shattered by occasional deep tillage or subsoiling to a depth of 14 to more than 16 inches. The beneficial effects of this measure should persist for many years. Some form of reduced tillage can be applied after the pan is shattered.

This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as timothy and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. The occasional flooding is the main problem, especially in areas used for hay. It should be considered when a grazing system is designed.

A significant acreage of this soil is mixed native forest. Most of this acreage is along the smaller tributary streams, in narrow strips bordering the larger streams, and in other areas too small for the use of farm machinery. A few small areas that have been cleared are planted to black walnut trees. In many of the wooded areas, selective cutting and stand improvement are needed. Plant competition is the main problem. It can be controlled by cutting and by treating the stumps of woody plants with herbicide. No other major problems affect planting or harvesting.

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

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

40A—Racoon silt loam, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping, poorly drained soil is on low stream terraces and foot slopes. In some areas it is occasionally flooded for brief periods. Also, it is subject to ponding. Most areas range from 20 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 12 inches thick. The subsurface layer is light brownish gray, mottled, friable silt loam about 20 inches thick. The subsoil to a depth of 60 inches or more is mottled, firm silty clay loam. It is light brownish gray in the upper part and grayish brown in the lower part. In some areas the subsurface layer is dense and brittle.

Included with this soil in mapping are some scattered areas of the somewhat poorly drained Auxvasse soils. These soils make up about 10 percent of the unit.

Permeability is slow in the Racoon soil. Available water capacity is high. Runoff is slow to ponded. Natural fertility is low, and the content of organic matter

is moderately low. The surface layer is friable and can be easily tilled. Root development is somewhat restricted by a seasonal high water table near or above the surface during most winter and spring months.

Most areas are used for cultivated crops, pasture, or hay. A few small areas remain forested. This soil is better suited to soybeans than to corn because spring planting is delayed by wetness in most years. Some kind of surface drainage system is needed in most areas. Some swampy or seepy areas, however, cannot be easily drained. Areas where the surface drainage system is adequate are suited to wheat.

About 10 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress in summer-grown crops during most years. Because of the repeated use of moldboard plows and, more recently, the use of heavy farm equipment, traffic pans have formed. These are compacted layers below the plow layer. They restrict the movement of air and water and reduce the amount of water that is available to plants. They can be shattered by occasional deep tillage or subsoiling to a depth of 14 to more than 16 inches.

On foot slopes that are long and very gently sloping, erosion-control measures are needed. These measures include no-till planting or another system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a cropping sequence that includes pasture or hay during at least 1 year out of every 4.

This soil is moderately suited to water-tolerant, shallow-rooted legumes, such as alsike clover, and to cool-season grasses, such as reed canarygrass. It is poorly suited to warm-season grasses and to hay. The wetness and the flooding are the main problems. The flooding should be considered when a grazing system is designed. A seedbed cannot be easily prepared during wet periods. A surface drainage system improves the suitability for the deeper rooted species.

A few small tracts support native trees, dominantly water-tolerant species, such as pin oak, swamp white oak, green ash, and sycamore. No significant amount of tree planting has been done on this soil. The trees selected for planting should be those that can withstand the wetness. Ridging the soil and then planting container-grown stock on the ridges can reduce the seedling mortality rate. Planting and harvesting activities should be restricted to dry periods. Windthrow is a hazard. This hazard can be reduced by block planting. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

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

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

43—Cedargap cherty loam. This very deep, nearly level, somewhat excessively drained soil is on narrow flood plains along small streams. It is frequently flooded for brief periods. Individual areas are long and narrow and range from 10 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, very friable cherty loam about 12 inches thick. The subsurface layer is very dark grayish brown and dark brown, friable very cherty loam about 24 inches thick. The substratum to a depth of 60 inches is brown and dark brown, friable extremely cherty loam. In places the surface layer is silt loam. In some areas the slope is 2 to 5 percent.

Included with this soil in mapping are some scattered areas of Gladden soils, which are loam to a depth of about 30 inches, and some areas of the loamy Pope soils. Also included are some areas of Midco soils, which are lighter colored than the Cedargap soil and have less clay. Included soils make about 15 percent of the unit.

Permeability is moderately rapid in the Cedargap soil. Available water capacity is low. Runoff is slow. Natural fertility is medium, and the content of organic matter is moderate. The chert hinders tillage. No restrictions affect root development.

About half the acreage of this soil is forested. Nearly all of the rest is used for pasture or hay. A few small areas are cultivated along with the adjacent areas.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as tall fescue and reed canarygrass; and to warm-season grasses, such as big bluestem and switchgrass. Droughtiness and flooding are the main problems. The species selected for planting should be those that can withstand the flooding.

A substantial acreage is native forest. A considerable acreage of abandoned cropland is reverting to forest. A few tracts have been planted to black walnut trees. In most of the wooded areas, selective cutting and stand improvement are needed. Seedling mortality is moderate. As a result, some replanting may be needed.

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

The land capability classification is IIIw. The woodland ordination symbol is 3F.

44—Gladden loam. This very deep, nearly level, well drained soil is on flood plains along small streams. It is occasionally flooded for brief periods. Individual areas are long and narrow and range from 5 to 60 acres in size.

Typically, the surface layer is brown, very friable loam about 12 inches thick. The subsoil is dark yellowish brown, friable loam about 20 inches thick. The substratum to a depth of 60 inches is brown, loose extremely cherty sandy loam.

Included with this soil in mapping are some scattered areas of the cherty Cedargap and loamy Pope soils. These soils make up about 15 percent of the unit.

Permeability is moderate in the upper part of the Gladden soil and rapid in the lower part. Available water capacity is moderate. Runoff is slow. Natural fertility is low, and the content of organic matter is moderately low. The surface layer is friable and can be easily tilled. No restrictions affect root development.

Most areas of this soil have been cleared of trees and are used for pasture, hay, or cultivated crops. Some areas are forested. These areas are mainly on the upper reaches of the narrow flood plains.

In areas that are large enough for the use of farm machinery, this soil is suitable for cultivated crops. It is somewhat better suited to small grain and grain sorghum than to corn and soybeans. Less than 7 inches of water is available for plant growth in this soil. This is not enough to prevent serious moisture stress in corn during the summer of most years. If corn is grown, the crop should be planted early in spring and high plant populations should be avoided. Because of the repeated use of moldboard plows and the use of heavy farm equipment, traffic pans have formed. These are compacted layers below the plow layer. They restrict the movement of air and water and reduce the amount of water that is available to plants. They can be shattered by occasional deep tillage or subsoiling to a depth of 14 to more than 16 inches. Delaying planting in spring generally minimizes the crop damage caused by floodwater.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as orchardgrass and reed canarygrass; and to warm-season grasses, such as indiangrass, big bluestem, and switchgrass. Droughtiness and flooding are the main problems. The species selected for planting should be those that can withstand the flooding.

A substantial acreage of this soil is native forest. A considerable acreage of abandoned cropland is reverting to forest. A few tracts have been planted to black walnut trees. In most of the wooded areas, selective cutting and stand improvement are needed. No major problems affect planting or harvesting.

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

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

45—Pope loam. This very deep, nearly level, well drained soil is on low stream terraces and on flood plains. It is occasionally flooded for brief periods, mainly in winter and early spring. The higher terraces are only rarely flooded. Individual areas range from 10 to 80 acres in size.

Typically, the surface layer is dark brown and dark yellowish brown, very friable loam about 12 inches thick. The subsoil is dark brown, very friable loam about 34 inches thick. The substratum to a depth of 60 inches or more also is dark brown, very friable loam.

Included with this soil in mapping are areas of soils on first bottoms. These soils are loamy sand throughout. Also included are areas of the cherty Cedargap soils along stream channels. Included soils make up about 15 percent of the unit.

Permeability and available water capacity are moderate in the Pope soil. Runoff is slow. Natural fertility is medium, and the content of organic matter is moderately low. The surface layer is friable and can be easily tilled, but a surface crust tends to form after periods of heavy rainfall. No restrictions affect root development.

Most areas of this soil are used for corn, soybeans, or wheat or for pasture or hay. A few areas are forested.

This soil is suited to cultivated crops. Somewhat less than 9 inches of water is available for plant growth in this soil. This is enough to prevent serious moisture stress in corn during the summer of most years if the crop is planted early in spring and high plant populations are avoided. Because of the repeated use of moldboard plows and the use of heavy farm equipment, traffic pans have formed. These are compacted layers below the plow layer. They restrict the movement of air and water and reduce the amount of water that is available to plants. They can be

shattered by occasional deep tillage or subsoiling to a depth of 14 to more than 16 inches. The beneficial effects of this measure should persist for many years. Some form of reduced tillage can be applied after the pan is shattered. Although major floods are rare, serious scouring losses can occur during these floods in conventionally tilled areas used for row crops. As a result, minimum tillage or no-till planting may be needed.

This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as orchardgrass and timothy; and to warm-season grasses, such as indiangrass, big bluestem, and switchgrass. No serious problems affect pasture or hayland.

Most of the forested areas are on narrow flood plains. A few tracts have been planted to black walnut. In many of the wooded areas, selective cutting and stand improvement are needed. No significant problems affect tree growth, planting, or harvesting.

Because of the flooding, this soil generally is unsuitable for building site development and onsite waste disposal.

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

46F—Lily-Holstein-Ramsey loams, 14 to 35 percent slopes. These moderately steep and steep soils are on upland side slopes and foot slopes. The moderately deep, well drained Lily soil is mainly on south-facing side slopes and the long, tapering ends of ridges. The very deep, well drained Holstein soil is on north-facing side slopes and on foot slopes. The shallow, somewhat excessively drained Ramsey soil is on slope breaks and along drainageways. Individual areas occur as broad bands that are as much as several hundred acres in size. They are about 35 percent Lily soil, 30 percent Holstein soil, and 15 percent Ramsey soil. The three soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Lily soil is dark grayish brown, very friable loam about 3 inches thick. The subsurface layer is brown, very friable loam about 4 inches thick. The subsoil is about 22 inches thick. It is brown, friable loam in the upper part and yellowish red, firm sandy clay loam in the lower part. Hard sandstone bedrock is at a depth of about 29 inches.

Typically, the surface layer of the Holstein soil is very dark grayish brown, very friable loam about 4 inches. The subsurface layer is yellowish brown, very friable loam about 5 inches thick. The subsoil extends to a depth of more than 60 inches. It is strong brown, friable loam in the upper part; dark brown, firm clay loam in the next part; and dark brown, mottled, firm clay loam in the lower part.

Typically, the surface layer of the Ramsey soil is very dark grayish brown, very friable loam about 3 inches thick. The subsurface layer is brown, very friable loam about 3 inches thick. The subsoil is about 10 inches thick. It is yellowish brown, friable loam in the upper part and brown, friable sandy loam in the lower part. Hard sandstone bedrock is at a depth of about 16 inches.

Included with these soils in mapping are areas where sandstone bedrock crops out along small drainageways, areas of sandstone cliffs along the larger streams, and areas along fault lines where 20 to 50 percent of the surface is covered by sandstone boulders (fig. 6). Also included are small areas of the cherty Goss soils, mainly at the lower elevations. Included areas make up about 20 percent of the unit.

Permeability is moderately rapid in the Lily soil, moderate in the Holstein soil, and rapid in the Ramsey soil. Available water capacity is low in the Lily soil, high in the Holstein soil, and very low in the Ramsey soil. Runoff is rapid on all three soils. The content of organic matter and natural fertility are low. The root zone extends to a depth of more than 60 inches in the Holstein soil, but it is limited by the bedrock underlying the Lily and Ramsey soils.

Nearly all areas are forested, dominantly by the oak-hickory forest type. The only known native stands of shortleaf pine in the county are in areas of these soils (fig. 7). A very small acreage has been cleared of trees and is used for pasture. Because of a severe hazard of erosion, stoniness, and the moderately steep and steep, dissected slopes, these soils generally are unsuitable for cultivation. The low or very low available water capacity in the Lily and Ramsey soils is an additional limitation. All of these limitations also affect the use of these soils for pasture.

These soils support native hardwood stands that vary greatly in quality. The quality generally is good or excellent on the Holstein soil, fair or poor on the Lily soil, and very poor on the Ramsey soil. It varies, however, because the sandstone bedrock that underlies these soils is fractured in widely varying degrees. Excellent stands of white oak are established in many areas where the soils are not deep over bedrock. In many areas selective cutting and stand improvement are needed. No significant amount of tree planting has been done on these soils. Because of the shallowness to bedrock, the Ramsey soil generally is not managed for timber.

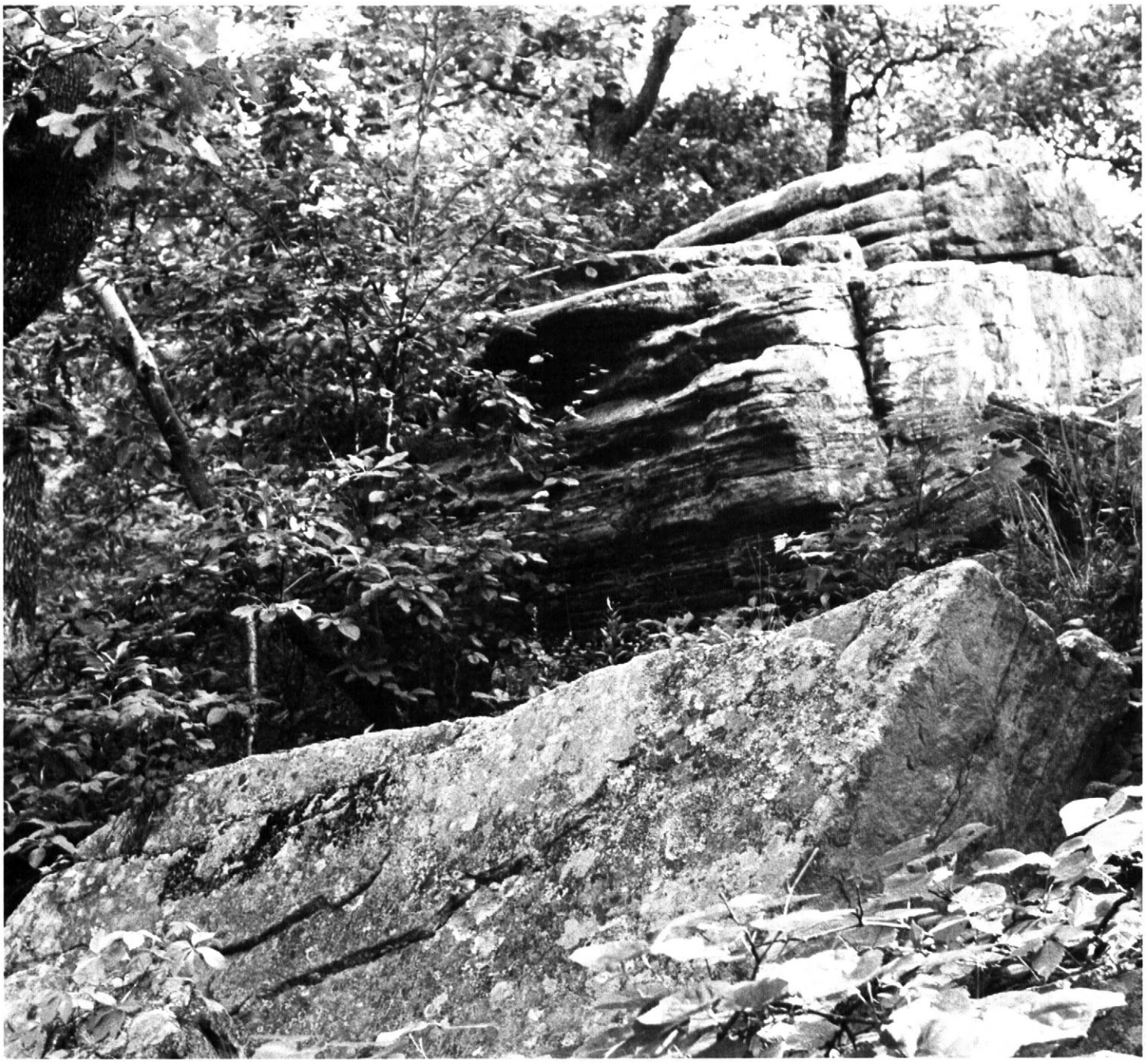

Figure 6.—Sandstone boulders along a fault line included in an area of Lily-Holstein-Ramsey loams, 14 to 35 percent slopes.

When timber is harvested, erosion is a hazard along logging roads and skid trails. It can be controlled by carefully selecting sites for the roads and trails and by building water breaks at selected intervals. Reseeding may be needed after the trees are harvested. Operating equipment is hazardous on these slopes. Logging roads and skid trails should be built on the contour. In the steepest areas, the logs should be yarded uphill to the roads and trails. Seedling mortality is a limitation on the Holstein soil. Planting container-grown stock increases the seedling survival rate.

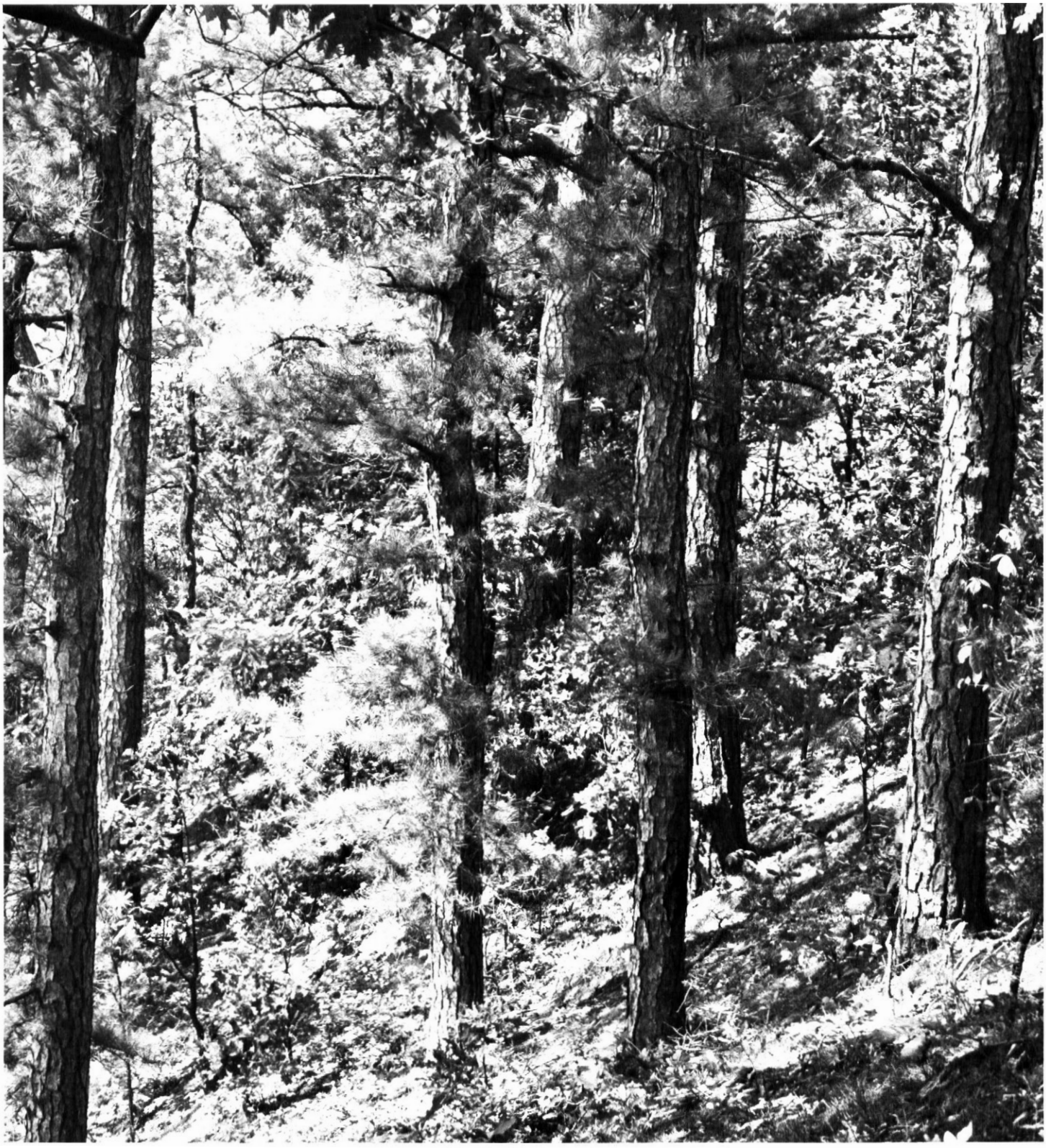

Figure 7.—Native shortleaf pine in an area of Lily-Holstein-Ramsey loams, 14 to 35 percent slopes.

These soils are unsuitable for building site development and onsite waste disposal because of the slope, the depth to bedrock, or both.

The land capability classification is VIIe. The woodland ordination symbol assigned to the Lily and Holstein soils is 3R, and that assigned to the Ramsey soil is 2R.

47D—Lily-Hobson-Ramsey complex, 9 to 14 percent slopes. These strongly sloping soils are in areas around the head of drainageways and on complex side slopes in the uplands. The moderately deep, well drained Lily soil is on short side slopes. The very deep, moderately well drained Hobson soil is on the tapering ends of ridges between drainageways. The shallow, somewhat excessively drained Ramsey soil is along the drainageways and on shoulder slopes. Most areas range from 10 to 150 acres in size. They are about 35 percent Lily soil, 35 percent Hobson soil, and 15 percent Ramsey soil. The three soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Lily soil is very dark grayish brown, very friable sandy loam about 4 inches thick. The subsurface layer is strong brown, very friable sandy loam about 4 inches thick. The subsoil is about 20 inches thick. It is yellowish red. It is friable loam in the upper part and firm sandy clay loam in the lower part. Hard sandstone bedrock is at a depth of about 28 inches.

Typically, the surface layer of the Hobson soil is very dark gray, friable loam about 3 inches thick. The subsurface layer is brown, friable loam about 4 inches thick. The subsoil is strong brown, firm clay loam about 16 inches thick. Below this is a fragipan of dark yellowish brown, brittle, very firm sandy clay loam about 21 inches thick. The substratum to a depth of 60 inches is strong brown, firm sandy clay loam.

Typically, the surface layer of the Ramsey soil is very dark gray, very friable sandy loam about 2 inches thick. The subsurface layer is brown, very friable sandy loam about 4 inches thick. The subsoil is strong brown, friable sandy loam about 6 inches thick. The substratum is strong brown sandy loam about 3 inches thick. Hard sandstone bedrock is at a depth of about 15 inches.

Included with these soils in mapping are areas where sandstone crops out on slope breaks and along drainageways. Also included are some scattered areas of Holstein soils. Included areas make up about 15 percent of the unit.

Permeability is moderate above the fragipan in the Hobson soil and slow in the pan. It is moderately rapid in the Lily soil and rapid in the Ramsey soil. Available water capacity is low in the Hobson and Lily soils and very low in the Ramsey soil. Runoff is rapid on all three soils. Natural fertility and the content of organic matter are low. The root zone is restricted by the fragipan in the Hobson soil and by the bedrock underlying the Lily and Ramsey soils. The Hobson soil has a perched water table at a depth of 1.5 to 3.0 feet for brief periods in late winter and early spring.

Most areas are forested. Some areas of the Hobson soil and a few areas of the Lily soil have been cleared of trees and are used as pasture. These areas generally are not used for cultivated crops or hay because most fields are too small and too isolated for the use of large farm equipment. Some areas that previously were cleared and cultivated have been abandoned and are reverting to forest. A few such areas have been planted to pine.

The stands of native forest on these soils vary greatly in quality. Stands of good-quality white oak are established in areas where the underlying bedrock is highly fractured and in areas of the included Holstein soils. In some areas selective cutting and stand improvement are needed. In other areas, however, the cost of managing for commercial timber is excessive. The fragipan in the Hobson soil and the bedrock underlying the Ramsey soil restrict the rooting depth, causing windthrow damage and seedling mortality. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Because of the seedling mortality rate, reinforcement planting may be needed.

The Hobson and Lily soils are suited to some legumes, such as lespedeza and birdsfoot trefoil; to some cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, little bluestem, and indiangrass. They are moderately suited to most other legumes and cool-season grasses. Shallow-rooted species that can withstand droughtiness should be selected for planting. Erosion is a serious hazard in newly seeded areas. Timely tillage and a quickly established ground cover are necessary to prevent excessive soil loss.

The Lily and Ramsey soils generally are unsuitable for building site development and onsite waste disposal because of the limited depth to bedrock. If the Hobson soil is used for building site development, the wetness and the slope are limitations. The wetness can be reduced by installing tile drains around footings and foundations. The buildings should be designed so that they conform to the natural slope of the land. Otherwise, some land shaping is necessary. Septic tank

absorption fields do not function well because of the wetness and the slowly permeable fragipan. Properly designed sewage lagoons can function adequately if the site is sufficiently leveled.

The land capability classification is VIe. The woodland ordination symbol assigned to the Hobson and Ramsey soils is 2D, and that assigned to the Lily soil is 3A.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 74,000 acres in the survey area, or nearly 12 percent of the total acreage, meets the soil requirements for prime farmland. This land is mainly on the flood plains in areas of associations 7 and 8, which are described under the heading "General Soil Map Units." Most of the prime farmland is used for cultivated crops. The crops grown on this land, mainly corn and soybeans, account for much of the county's total agricultural income each year.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures. The naturally wet soils in Franklin County generally have been adequately drained through the application of drainage measures or the incidental drainage that results from farming or other kinds of land development.

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

Leonard A. Knoernschild, district conservationist, and Paul B. Freese, soil conservation technician, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Approximately 55 percent of the acreage in Franklin County is cleared of trees. About a third of the cleared land is used as cropland, and the rest generally is used as pasture *(5)*. On the cropland, row crops are grown year after year or a rotation system is applied. Corn, soybeans, wheat, and grain sorghum are the principal cultivated crops. Hay is harvested on a large acreage of the land used for crop rotations or for permanent pasture.

The potential for increased crop production in Franklin County is good. Production can be increased by extending the latest technology to all of the cropland in the county. This survey can facilitate the application of such technology. About 105,000 acres in the county occurs as nearly level soils that generally are suitable for intensive cultivation. An additional 160,000 acres occurs as gently sloping and moderately sloping soils that are suitable for cultivated crops if erosion is controlled. Trees have been cleared from most of this acreage.

The main management needs on the cropland and pasture in Franklin County are measures that control water erosion and improve or maintain fertility and tilth. A drainage system is needed in some areas, and irrigation is needed in others.

Water erosion has been a serious problem in the county *(8)*. It has been controlled through the efforts of the Franklin County Soil and Water Conservation District, especially in areas of Menfro and Crider soils, where terraces and conservation cropping systems have helped to maintain productivity. In recent years, however, economic pressures and a trend away from general farming have increased the acreage used for cultivated crops in many areas of these very deep, silty soils in the uplands. This increase has intensified the need for conservation measures on these soils.

In recent decades a significant shift from cultivated crops to pasture or hay or to idle land has occurred on Union and Hobson soils, both of which have a fragipan, and on Bucklick and Hartville soils, which have a high content of clay in the subsoil. This shift has decreased the susceptibility of these soils to erosion.

Erosion is the major hazard on the more sloping soils used for cultivated crops. It is a hazard in areas where slopes are more than 2 percent and in areas where long slopes are 1 percent or more. Most of the soil loss occurs as sheet and rill erosion, but gullying also is a problem. Loss of topsoil reduces the level of fertility and the available water capacity and results in deterioration of tilth. It is especially damaging in areas of Union, Hobson, Bucklick, and Hartville soils, where the available water capacity and, to some extent, the rooting depth are limited by a fragipan or by a high content of clay in the subsoil. Many fields have clayey spots where seedbed preparation and tillage are difficult because the original friable surface soil has been removed through erosion.

Controlling erosion on farmland not only helps to maintain the productivity of the soils but also minimizes the pollution of streams by sediment and improves water quality for municipal use, for recreation, and for fish and wildlife. Erosion control prolongs the useful life of ponds and lakes by preventing sedimentation.

Erosion can be controlled by crop rotations that include close-grown crops, by a permanent plant cover, and by conservation tillage, contour farming, terraces, diversions, and grade-stabilization structures. Crop rotations can reduce the hazard of erosion by alternating cultivated crops with close-grown crops. Growing grasses and legumes for pasture or hay can reduce soil losses to negligible levels. When a pasture is established, erosion is a serious hazard following seedbed preparation. This hazard can be reduced by chisel-plow tillage, which leaves plant residue on the surface, or by seeding the grasses and legumes in a nurse crop of small grain.

Conservation tillage minimizes plowing and cultivation and leaves protective amounts of crop residue on the surface. As a result, it increases the rate of water infiltration, reduces the runoff rate and the hazard of erosion, and helps to maintain good tilth. Plowing in spring rather than fall allows a protective cover of crop residue to remain on the surface throughout the winter. Even more effective is a tillage method that leaves crop residue on the surface during the growing season. Chisel plows and direct planting in conventionally plowed fields minimize tillage. Currently, no-till planters are gaining acceptance.

Terraces and diversions reduce the length of slopes and thus minimize runoff and erosion. They are most practical on deep, well drained or moderately well drained soils that have uniform slopes. Menfro, Crider, and Winfield soils are examples. Some areas of Bucklick soils also are well suited to terracing. Terraced fields should be farmed on the contour.

Soil fertility significantly affects crop yields. Natural fertility is commonly high in the soils on the flood plains along the Missouri River. Only nitrogen and small amounts of phosphate and potash are needed on these soils. No additional lime is needed. Natural fertility is medium in Haymond soils on flood plains and in Menfro and Crider soils on uplands. Light or moderate applications of lime and moderate, balanced applications of nitrogen, phosphate, and potash are needed on these soils. Other soils in the county are commonly low in natural fertility and require heavier applications of lime and fertilizer if they are used for cultivated crops or improved pasture.

On all of the soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to be applied.

Soil tilth affects seedbed preparation, seed germination, and water infiltration. Soils with good tilth are granular and porous. Regular additions of organic material help to maintain good tilth.

Most of the cultivated soils in the county have a surface layer of silt loam or loam that is only moderate in content of organic matter. If these soils are frequently cultivated, soil structure generally becomes weak and soil particles at the surface can run together or puddle during periods of heavy rainfall. Under these conditions,

water infiltration is impeded. Also, the runoff rate and the hazard of erosion are increased in the more sloping areas. A hard crust, which forms when the surface dries, can prevent seedling emergence. Tillage by a rotary hoe may be needed because of the crusting. The tendency to crust is most severe on Hobson, Pope, and other soils that have a surface layer of loam or sandy loam.

The nearly level Booker soils, which have a clayey surface layer, are commonly plowed in the fall so that tilth is improved for spring planting. These soils can be fall plowed without a significant risk of erosion. Fall plowing of the more sloping soils in the uplands, on the other hand, results in serious soil losses. Such losses can be catastrophic when hard rains follow partial thawing of the bare, frozen surface layer.

Wetness is a major management concern on about 20,000 acres in the county. The naturally wet soils are characterized by a low position on the landscape, restricted permeability, or both. A drainage system has been installed in the Waldron and Booker soils on low flood plains along the Missouri River. The management needed on these soils includes maintenance of existing ditches and in places redesign of the drainage system. The same management is needed on the Bremer soils on stream terraces.

The Auxvasse and Hartville soils on stream terraces are naturally wet because of a slowly permeable or very slowly permeable, clayey subsoil and because of slow runoff. Diverting upland runoff can reduce the wetness in some areas of these soils. Because of a dense, brittle subsurface layer, the silty Twomile soils not only are naturally wet in the spring but also are droughty in the summer. Deep plowing or chiseling can break up the subsurface layer.

Irrigation increases yields in most years by supplying supplemental water during critical growth periods. It also reduces the risk of double cropping soybeans into wheat stubble by ensuring enough water for seed germination and early plant growth. Currently, center-pivot and rain-gun irrigation systems are used in the county. Nearly all of the irrigated areas are on bottom land, mainly on the flood plains along the Missouri River. A minor acreage on uplands is irrigated by waste water collected in lagoons used in animal-feeding operations.

Field crops are a mainstay of agriculture in Franklin County. In 1984, corn was grown on about 24,000 acres, soybeans on 20,000 acres, wheat on 19,000 acres, and grain sorghum on 7,000 acres *(5)*. Oats, barley, and rye currently are grown on only a small acreage.

As production costs have increased in recent years, there has been a strong trend to limit the production of corn and, to a lesser extent, soybeans to very deep soils that have a high or very high available water capacity. Nearly all of the corn in the county and most of the soybeans are grown on the Blake, Haynie, and Waldron soils on the flood plains along the Missouri River; on Haymond soils on other flood plains; and on Menfro and Crider soils on uplands. Many areas of the more droughty soils currently are used for grain sorghum or for grass-legume pasture rather than for corn or soybeans.

Wheat and other small grain crops that mature before periods of low summer rainfall grow well on nearly all of the tillable soils in the county if the level of fertility and surface drainage are adequate. The acreage of these crops has declined because of low grain prices and increased production costs. The soils have excellent potential for increased production of these crops.

Pasture and hayland make up a very extensive acreage in the county. They produce feed for many beef cow herds and several large dairies.

Alfalfa is the best suited forage species on very deep, well drained soils, such as Menfro, Crider, and Haymond. Soils that have a fragipan or are characterized by a limited depth to bedrock or by wetness are better suited to red clover or lespedeza than to other species. If fertilizer and lime are applied, most of the soils that are suited to pasture or hay can support red clover, ladino, and other clovers. Tall fescue is by far the dominant forage plant, but this grass has been plagued by disease and parasite problems in recent years. Many growers are replacing it with other grasses. The cool-season grasses that are suited to most of the soils in the county include orchardgrass, bromegrass, timothy, and redtop.

Native warm-season grasses grow well in the county. They can provide forage after the cool-season grasses become dormant in midsummer. They require a long establishment period. Measures that prevent overgrazing are needed. Prescribed burning every 3 to 5 years improves the forage. It generally is necessary because of weeds interspersed among the warm-season grasses. Bluestems, switchgrass, and indiangrass, which are tall grasses, once grew on small, isolated prairies or savannas throughout the county.

Overgrazing reduces the vigor of pasture plants and permits an increase in the extent of weeds, such as broom sedge and ironweed. Rotation grazing among several pastures gives the plants on each pasture a chance to build up carbohydrate reserves during a rest period. Deferring grazing in early spring helps to

Figure 8.—A commercial vineyard and winery in an area of Menfro silt loam, 5 to 9 percent slopes, eroded.

prevent serious compaction, especially on soils that have a seasonal high water table.

Specialty crops are grown commercially on a small scale in Franklin County. They include grapes, strawberries, tree fruits, Christmas trees, and nursery plants. In recent years two small commercial wineries have been established in the northwestern part of the county (fig. 8). Menfro and Crider soils are especially well suited to grape culture.

Many vegetables, small fruits, and tree fruits grow best on deep or very deep soils that are characterized by good natural drainage and that warm up early in the spring. Menfro, Crider, and Bucklick soils have the best potential for the commercial production of these crops.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension

agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(13)*. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

The capability classification of each map unit, except for Pits, quarries, and the Pits-Udorthents complex, is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

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

About 45 percent of Franklin County is forested. The oak-hickory forest is the major timber type on the soils in the uplands. The most common tree species are white oak, northern red oak, black oak, post oak, blackjack oak, black walnut, and hickories. Species composition and quality vary, depending on soil properties and site characteristics.

The soil serves as a reservoir for moisture, provides an anchor for roots, and supplies most of the plant nutrients available for tree growth. The soil properties that directly or indirectly affect these growth requirements include reaction, natural fertility, drainage,

texture, and depth. Position on the landscape also is important.

Available water capacity is influenced primarily by the texture, the rooting depth, and the content of chert or stones. Very deep soils, such as Menfro and Crider, generally are characterized by a high available water capacity and by good natural fertility and internal drainage. These soils can produce good-quality stands dominated by white oak and northern red oak. Black walnut may be an important species in these stands.

Some soil properties reduce the rate of tree growth and affect species composition. Goss and other soils that have a high content of chert, for example, have a much lower available water capacity than other soils. The rooting depth also influences the amount of water available to the trees. It is restricted in soils that have a fragipan, such as Hobson soils, and in soils that are shallow over bedrock, such as Gasconade soils. The potential of these soils for good-quality trees is limited.

Aspect also affects growth rates and species composition. South- and west-facing slopes have higher average soil temperatures and evapotranspiration rates than north- and east-facing slopes. Soil moisture is depleted more quickly on the south and west aspects. As a result, growth rates are slower and the stand commonly has a greater percentage of the lower quality species, such as post oak and blackjack oak.

The only bottom land in the county that remains forested is along stream corridors and in areas where drainage is poor. The soils on this bottom land support the tree species most typical of an elm-ash-cottonwood forest. They are highly productive forest soils. The Blake-Waldron-Haynie association, which is described under the heading "General Soil Map Units," supports a mixture of bottom-land species, such as ash, boxelder, soft maple, and cottonwood. The Haymond-Pope association supports a mixture of ash, sycamore, elm, hackberry, cottonwood, soft maple, and black walnut. The stands in many of the smaller areas of bottom land that are adjacent to the Ozark uplands include the species of oak that are common in the uplands.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, a high content of rock fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

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

The hazard of erosion is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed also are subject to erosion. Ratings of the hazard of erosion are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality

are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and the slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

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

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

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

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mainly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service, the Missouri Department of Conservation, and the Cooperative Extension Service or from a commercial nursery.

Recreation

Edward A. Gaskins, biologist, Soil Conservation Service, helped prepare this section.

In 1980, a total of 17,820 acres in Franklin County was developed for recreational uses *(11)*. The ownership of this acreage is 64 percent state; 9 percent private; 3 percent municipal; 2 percent federal, school, and county; and 22 percent other. Meramec State Park and Little Indian Creek State Forest, each of which is more than 3,000 acres in size, are the largest public recreational areas in the county.

The recreational facilities in the county include water sports areas; golf courses; six public hunting areas totaling more than 7,000 acres in size; camping areas; hiking, horse, and nature trails; sports fields; game courts; gun and archery ranges; wildlife-viewing areas; picnic areas; arenas; developed caves; and a fairground. Several public access areas serve fishermen and other boaters on the Meramec, Bourbeuse, and Missouri Rivers.

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 also are 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, helped prepare this section.

Franklin County is one of the 13 counties in Missouri that make up the North and East Ozark Border Zoogeographic Region. Prior to settlement, all of the county was wooded, except for some small upland prairies and a few swamps on bottom land *(9)*. Currently, nearly half of the county supports some form of woody vegetation. The woodland is well interspersed with openland. The many transition areas between woodland and openland are of favorable quality for upland game species. Much of the county provides good to excellent habitat for both openland and woodland wildlife.

In contrast to trends in the more intensively farmed areas of Missouri, long-term land use changes in Franklin County have greatly improved the habitat for wildlife. A variety of factors, many of them soil related, underlies these changes. In recent decades a major shift from cropland to pasture or hayland or to idle land has occurred on soils that have a moderate or low available water capacity. Many abandoned fields that are eroded or are too small for the use of large farm equipment have been invaded by eastern redcedar and other trees, which are interspersed with grasses, forbs, and shrubs. Many small farms that once were intensively cropped and pastured are now used primarily for recreational development or wildlife habitat. Briers, shrubs, and trees have overgrown miles of fence rows. These trends are evident throughout the county, especially in areas of the Union-Beemont, Bucklick-

Gatewood-Gasconade, and Hobson-Lily-Ramsey associations, which are described under the heading "General Soil Map Units."

Thousands of farm ponds and small lakes provide water and cover for wildlife throughout the county. They also provide opportunities for fishing. Fences in the areas adjacent to the ponds and lakes exclude livestock.

While the net effect of long-term land use changes has been strongly positive, some trends in the county have a negative impact on wildlife habitat. A recent increase in the acreage of row crops has caused some loss of habitat in areas of the Menfro, Blake-Waldron-Haynie, and Haymond-Pope associations. While not a significant threat in the county, urban development has caused some irreversible loss of habitat.

Bobwhite quail, dove, and rabbit are the major openland game species in the county. The population of quail and rabbits generally is good. Much of the hunting pressure for these species comes from within the county. An abundant supply of food that is close to good cover is necessary to carry a high population of these species. The resident dove population is fair and is augmented each fall by migratory flights. The migratory birds tend to congregate on harvested corn fields. The county has no native pheasants, but some ring-necked pheasants are stocked annually by three hunting clubs. A small but stable population of woodcocks receives light hunting pressure. A few ruffed grouse have moved south into Franklin County from Warren County, and the number of this species probably is increasing. The songbird population is excellent.

Whitetail deer, wild turkey, fox squirrel, and gray squirrel are the major woodland game species in the county. Hunting pressure from St. Louis and St. Charles and from local residents is heavy for both turkey and deer. In 1985, Franklin County ranked third among Missouri counties in the number of deer killed by hunters. The deer population is steadily increasing. The turkey population is excellent. All of the habitat suitable for this species is occupied.

The population of squirrels fluctuates widely. It increases following years of good mast production. A loss of den trees through the cutting of firewood can decrease the population.

The furbearer population is good. Harvest records show that raccoon, muskrat, opossum, gray fox, beaver, mink, coyote, and striped skunk are the principal species trapped. Bobcat and red fox also are trapped.

Except for the heavily forested Goss-Hobson association, the associations on uplands have a fairly even mixture of openland and woodland. These associations provide good to excellent habitat for both openland and woodland wildlife because of the well dispersed cover types and the generally adequate water supplies.

The Menfro and Crider-Bucklick associations are about 65 percent openland. Of the associations on uplands, they provide the best winter food supplies, mainly from harvested grain fields and from fall-seeded small grain. The main concerns in managing these associations for wildlife are preserving and improving the existing cover.

About 60 percent of the Bucklick-Gatewood-Gasconade association and 50 percent of the Union-Beemont and Hobson-Lily-Ramsey associations are wooded. Establishing food plots for both woodland and openland wildlife is the principal concern in managing these associations for wildlife. Food plots for woodland wildlife are even more important in areas of the Goss-Hobson association, about 80 percent of which is forested. Logging activities can create openings in the forest canopy and thus permit the growth of understory plants.

The associations on bottom land generally are cleared. About 90 percent of the Blake-Waldron-Haynie association and 80 percent of the Haymond-Pope association are openland. The habitat for openland wildlife is fair or poor. Because row crops are grown on a high percentage of the acreage, the fields provide virtually no cover during most of the year, especially in areas of the Blake-Waldron-Haynie association. The uncleared acreage in this association provides excellent habitat for woodland wildlife.

The Haymond-Pope association, which is less intensively cultivated, provides somewhat better habitat for openland wildlife than the Blake-Waldron-Haynie association. Both of these associations provide winter food, mainly in harvested grain fields, to the species of wildlife that can find cover in the adjacent areas. Preserving the existing cover is the major concern in managing these associations for wildlife. Winter food supplies can be increased by limiting fall plowing to areas of the clayey soils, where good tilth is necessary for spring planting.

Seeds and seed mixtures for food plots that meet the needs of both openland and woodland wildlife and seedlings of trees and shrubs that provide food and cover for wildlife are available from the Missouri Department of Conservation. They are furnished at no cost to cooperators who agree to establish properly located food plots of suitable size.

Warm-season grasses are being established on an increasing acreage in the county. Proper management of these grasses postpones grazing or haying until midsummer, allowing game birds and songbirds to hatch without disturbance of their nests and permitting whitetail fawns to grow big enough to escape haying equipment.

The sloughs and flood-gouged potholes in areas of the Blake-Waldron-Haynie association provide virtually the only true wetland wildlife habitat in the county. The streams and rivers flowing through the Haymond-Pope and Blake-Waldron-Haynie associations provide some habitat for mallards and wood ducks and for a small resident flock of Canada geese. The county currently has very few permanent marshes and has no large areas where waterfowl concentrate during fall migrations. The principal waterways providing habitat for wood ducks are the Missouri, Bourbeuse, and Meramec Rivers and Boeuf and St. John's Creeks.

The county has 279 miles of permanently flowing streams *(6)*. The most important of these are the Missouri, Bourbeuse, Meramec, and Little Meramec Rivers and St. John's, Boeuf, and Berger Creeks. These waters provide habitat for largemouth bass, smallmouth bass, rock bass, catfish, walleye, suckers, carp, and sunfish. The Missouri River, which borders the county for 41 miles, is fished commercially for carp, carpsucker, buffalo, sturgeon, and paddlefish and for channel, blue, and flathead catfish.

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 also are considerations. Examples of grain and seed crops are corn, wheat, and grain sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and the slope. Soil temperature and soil moisture also are considerations. Examples of grasses and legumes are orchardgrass, bluegrass, clover, and alfalfa.

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

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

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, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cutgrass, cattail, rushes, sedges, and reeds.

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

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

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

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

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, 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 should be considered in planning, in site selection, and in design.

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

This information can be used to (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, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and 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 or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

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

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

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

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

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and 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 or to a cemented pan, 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 or to a cemented pan, 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 off site, transported to the landfill, and spread over the waste.

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

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

Construction Materials

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

construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

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

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. 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 as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

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

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal 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. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; 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, hazard of erosion, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone 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 or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

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

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

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help 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 (fig. 9). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "cherty." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

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

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

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-

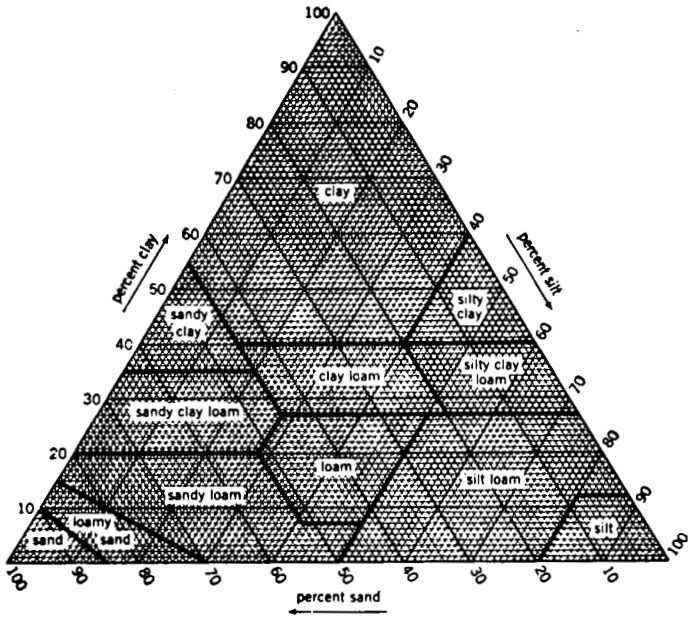

Figure 9.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

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

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

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

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

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

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

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

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

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available

water capacity is not an estimate of the quantity of water actually available to plants at any given time.

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

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

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

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

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

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

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

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

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

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.
5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.
6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

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

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of

segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

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

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(14)*. 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 Alfisol.

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 Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

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 Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that has a udic moisture regime).

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

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

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

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (12)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (14)*. 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."

Auxvasse Series

The Auxvasse series consists of very deep, somewhat poorly drained, very slowly permeable soils on stream terraces. These soils formed in loess and old alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Auxvasse silt loam, 0 to 3 percent slopes, 1,500 feet south and 20 feet west of the northeast corner of sec. 5, T. 42 N., R. 2 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; moderate very fine granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

E—9 to 17 inches; brown (10YR 5/3) silt loam; moderate thin platy structure; friable; common fine roots; many fine concretions of iron and manganese oxide; medium acid; abrupt smooth boundary.

B/E—17 to 20 inches; dark yellowish brown (10YR 4/4) silty clay (B); strong fine subangular blocky structure; friable; brown (10YR 5/3) silt loam (E) thickly coating peds and filling cracks; common fine roots; strongly acid; clear smooth boundary.

Btg1—20 to 32 inches; dark grayish brown (10YR 4/2) silty clay; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate very fine subangular blocky structure; firm; few fine roots; many distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; very strongly acid; clear smooth boundary.

Btg2—32 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; weak medium prismatic structure parting to moderate very fine subangular blocky; firm; few fine roots; few distinct clay films on faces of peds; very strongly acid; clear smooth boundary.

Cg—40 to 62 inches; grayish brown (2.5Y 5/2) silt loam; common medium prominent dark yellowish brown (10YR 4/6) mottles; massive; firm; strongly acid.

The thickness of the solum ranges from 40 to more than 60 inches. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The Bt horizon has mottles with hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The content of clay in this horizon ranges from 35 to 60 percent.

Bardley Series

The Bardley series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in cherty sediments and clayey material or dolomite residuum. Slopes range from 20 to 50 percent.

Typical pedon of Bardley cherty silt loam, 20 to 50 percent slopes, 800 feet south and 2,400 feet west of the northeast corner of sec. 12, T. 40 N., R. 1 W.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) cherty silt loam, light brownish gray (10YR 6/2) dry; moderate very fine granular structure; very friable; many fine roots; about 15 percent chert fragments; medium acid; abrupt smooth boundary.

E—2 to 7 inches; light yellowish brown (10YR 6/4) cherty silt loam; weak very fine granular structure; very friable; about 20 percent chert fragments; strongly acid; clear smooth boundary.

2Bt1—7 to 13 inches; yellowish red (5YR 4/6) clay; moderate very fine subangular blocky structure; firm; common fine roots; few faint clay films on faces of peds; about 10 percent chert fragments; strongly acid; clear smooth boundary.

2Bt2—13 to 28 inches; red (2.5YR 4/6) clay; moderate very fine subangular blocky structure; firm; few fine roots; about 5 percent chert fragments; common faint clay films on faces of peds; strongly acid; clear wavy boundary.

2Bt3—28 to 33 inches; yellowish red (5YR 4/6) cherty clay; common prominent yellowish brown (10YR 5/8) mottles; weak very fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; about 15 percent soft chert fragments; slightly acid; abrupt wavy boundary.

2R—33 inches; hard dolomite bedrock.

The thickness of the solum, or the depth to bedrock, ranges from 20 to 40 inches. The content of chert ranges from 10 to 35 percent in the A horizon and in the upper part of the B horizon. The A horizon is cherty or very cherty silt loam. The 2Bt horizon has value of 4 or 5 and chroma of 4 to 6. It is clay or cherty clay.

Beemont Series

The Beemont series consists of deep, moderately well drained soils on uplands. These soils formed in cherty sediments and shale and sandstone residuum. Permeability is moderately rapid in the upper part of the profile and very slow in the lower part. Slopes range from 9 to 20 percent.

Typical pedon of Beemont cherty silt loam, 9 to 20 percent slopes, 1,650 feet north and 2,250 feet east of the southwest corner of sec. 34, T. 44 N., R. 3 W.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) cherty silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; very friable; many fine roots; about 15 percent chert fragments; slightly acid; abrupt smooth boundary.
E1—2 to 7 inches; yellowish brown (10YR 5/4) cherty silt loam; weak very fine granular structure; friable; many fine roots; about 20 percent chert and sandstone fragments; strongly acid; clear smooth boundary.
E2—7 to 17 inches; light yellowish brown (10YR 6/4) very cherty silt loam; weak fine granular structure; friable; common fine roots; about 30 percent chert and sandstone fragments; medium acid; clear smooth boundary.
2Bt1—17 to 22 inches; yellowish red (5YR 4/6) clay; moderate very fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; about 10 percent chert fragments; very strongly acid; clear wavy boundary.
2Bt2—22 to 36 inches; yellowish brown (10YR 5/8) clay; few fine prominent pale brown (10YR 6/3) mottles; moderate very fine subangular blocky structure; firm; few faint clay films on faces of peds; about 10 percent chert fragments; very strongly acid; clear wavy boundary.
2Bt3—36 to 52 inches; mottled dark yellowish brown (10YR 4/4) and grayish brown (10YR 5/2) cherty clay; weak very fine subangular blocky structure; firm; few faint clay films on faces of peds; about 15 percent chert fragments; few flat sandstone fragments as much as 5 inches long in the lower part; very strongly acid; abrupt smooth boundary.
3R—52 inches; hard, fractured sandstone bedrock.

The thickness of the solum ranges from 40 to about 60 inches. The A horizon is silt loam, loam, or the cherty analogs of these textures. The E horizon has value of 4 to 6 and chroma of 2 to 4. It is cherty or very cherty silt loam or cherty loam. The Bt horizon has value of 4 to 6 and chroma of 2 to 8. The content of clay in this horizon ranges from 60 to about 85 percent.

Blake Series

The Blake series consists of very deep, somewhat poorly drained, moderately permeable soils on the flood plains along the Missouri River. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Blake silty clay loam, in an area of the Blake-Waldron complex; 2,900 feet east and 1,100 feet north of the southwest corner of sec. 9, T. 44 N., R. 1 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.
C1—8 to 20 inches; dark grayish brown (10YR 4/2) silty clay loam; weak fine subangular blocky structure; firm; few fine roots; slightly effervescent; mildly alkaline; clear smooth boundary.
C2—20 to 41 inches; dark grayish brown (10YR 4/2) silt loam; few fine faint very dark grayish brown (10YR 3/2) mottles; massive; friable; few thin strata of brown (10YR 5/3) and dark gray (10YR 4/1) silty clay; few fine roots; slightly effervescent; mildly alkaline; clear smooth boundary.
C3—41 to 60 inches; dark grayish brown (10YR 4/2) silt loam; massive; firm; few thin strata of brown (10YR 5/3) and dark gray (10YR 4/1) silty clay; slightly effervescent; mildly alkaline.

The thickness of the solum is less than 10 inches. It is the same as the thickness of the A or Ap horizon. The depth to horizons that are less clayey than silty clay loam generally is 18 to 35 inches. The A horizon typically is silty clay loam, but the range includes silt loam. The C horizon is dominantly silty clay loam, silt loam, or very fine sandy loam, but it has strata of coarser or finer textured material.

Booker Series

The Booker series consists of very deep, very poorly drained, very slowly permeable soils on the flood plains along the Missouri River. These soils formed in thick deposits of clayey alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Booker silty clay, in an area of Waldron-Booker silty clays; 4,000 feet south and 1,900 feet west of the northeast corner of sec. 9, T. 44 N., R. 2 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; firm; few fine roots; neutral; abrupt smooth boundary.
Bw1—8 to 14 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; firm; few fine roots; neutral; clear smooth boundary.

Bw2—14 to 36 inches; very dark gray (10YR 3/1) clay, gray (10YR 5/1) dry; few fine prominent yellowish brown (10YR 5/6) mottles; massive; firm; few fine roots; neutral; clear smooth boundary.
Cg1—36 to 48 inches; dark gray (10YR 4/1) clay; few fine distinct brown (10YR 5/3) mottles; massive; firm; neutral; clear smooth boundary.
Cg2—48 to 60 inches; dark gray (10YR 4/1) clay; common fine prominent yellowish brown (10YR 5/6) mottles; massive; firm; few pockets of brown, silty material; neutral.

The thickness of the solum ranges from 30 to 48 inches. The A horizon typically is silty clay, but the range includes clay. The Bw horizon has chroma of 1 or 2.

Bremer Series

The Bremer series consists of very deep, poorly drained soils on low stream terraces. These soils formed in alluvium. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Typical pedon of Bremer silty clay loam, 2,300 feet west and 700 feet north of the southeast corner of sec. 30, T. 43 N., R. 1 E.

Ap—0 to 12 inches; black (10YR 2/1) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; friable; common fine roots; slightly acid; abrupt smooth boundary.
A—12 to 24 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; firm; few fine roots; medium acid; clear smooth boundary.
Btg1—24 to 35 inches; dark gray (10YR 4/1) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate very fine subangular blocky; firm; few fine roots; few faint clay films on faces of peds; medium acid; gradual smooth boundary.
Btg2—35 to 54 inches; dark gray (10YR 4/1) silty clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate very fine subangular blocky; firm; few fine roots; few faint clay films on faces of peds; medium acid; gradual smooth boundary.
Cg—54 to 60 inches; dark gray (10YR 4/1) silty clay loam; massive; firm; slightly acid.

The solum typically is 50 or more inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. It typically is silty clay loam, but in some pedons it is silty clay.

Bucklick Series

The Bucklick series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in a thin layer of loess and in the underlying clayey material or dolomite and shale residuum. Slopes range from 2 to 35 percent.

Typical pedon of Bucklick silt loam, 9 to 14 percent slopes, 1,150 feet east and 58 feet north of the southwest corner of sec. 32, T. 44 N., R. 2 W.

Ap—0 to 6 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate very fine granular structure; friable; many fine roots; slightly acid; clear smooth boundary.
Bt1—6 to 16 inches; yellowish red (5YR 4/6) silty clay loam; moderate very fine subangular blocky structure; firm; common fine roots; few faint reddish brown clay films on faces of peds; few coarse sand grains; strongly acid; abrupt smooth boundary.
Bt2—16 to 28 inches; yellowish red (5YR 5/6) silty clay; moderate very fine subangular blocky structure; firm; few fine roots; common distinct reddish brown clay films on faces of peds; few coarse sand grains; very strongly acid; gradual smooth boundary.
Bt3—28 to 34 inches; yellowish red (5YR 4/6) silty clay; few fine prominent brown (10YR 5/3) and strong brown (7.5YR 5/6) mottles; moderate very fine subangular blocky structure; firm; few fine roots; common distinct reddish brown clay films on faces of peds; about 5 percent chert fragments; few fine black stains; few coarse sand grains; very strongly acid; clear wavy boundary.
2Bt4—34 to 42 inches; yellowish red (5YR 4/6) very cherty silty clay; few fine prominent yellowish brown (10YR 5/6) and brown (7.5YR 5/4) mottles; moderate very fine subangular blocky structure; firm; common faint reddish brown clay films on faces of peds; few fine black stains; about 35 percent angular chert fragments; strongly acid; clear smooth boundary.
2Bt5—42 to 50 inches; brown (7.5YR 4/4) silty clay; weak fine subangular blocky structure; firm; few faint reddish brown clay films on faces of peds; common fine black stains and concretions of iron

and manganese oxide; about 10 percent chert fragments; slightly acid; clear smooth boundary.
2R—50 inches; hard dolomite bedrock.

The thickness of the solum, or the depth to bedrock, ranges from 40 to 60 inches. The content of clay in the control section ranges from 35 to 45 percent.

The Ap or A horizon has value of 4 or 5 and chroma of 2 to 4. Pedons in areas that have never been cultivated have an E horizon, which is silt loam 2 to 4 inches thick. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. The content of chert ranges from 0 to 10 percent in the upper part of this horizon and from 0 to 40 percent in the lower part. The 2Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5 and chroma of 4 to 8. It is silty clay, silty clay loam, or the cherty analog of these textures.

Cedargap Series

The Cedargap series consists of very deep, somewhat excessively drained soils on small flood plains along streams. These soils formed in cherty alluvium. Permeability is moderately rapid. Slopes range from 0 to 2 percent.

Typical pedon of Cedargap cherty loam, 1,550 feet south and 50 feet east of the northwest corner of sec. 23, T. 43 N., R. 1 W.

A1—0 to 12 inches; very dark grayish brown (10YR 3/2) cherty loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; very friable; many fine roots; about 15 percent chert fragments; medium acid; clear smooth boundary.
A2—12 to 30 inches; very dark grayish brown (10YR 3/2) very cherty loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; common fine roots; about 55 percent chert fragments; medium acid; clear smooth boundary.
A3—30 to 36 inches; dark brown (7.5YR 3/2) very cherty loam, brown (7.5YR 5/2) dry; weak fine granular structure; friable; common fine roots; about 45 percent chert fragments; medium acid; clear smooth boundary.
C1—36 to 48 inches; brown (7.5YR 4/2) extremely cherty loam; massive; friable; few fine roots; about 80 percent chert fragments; medium acid; clear smooth boundary.
C2—48 to 60 inches; dark brown (7.5YR 4/4) extremely cherty loam; massive; friable; few fine roots; about 70 percent chert fragments; slightly acid.

The thickness of the solum and of the mollic epipedon ranges from 24 to 40 inches. The C horizon has hue of 10YR or 7.5YR and value of 3 to 5. It is the cherty, very cherty, or extremely cherty analog of loam.

Crider Series

The Crider series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in the underlying silty and clayey material or limestone residuum. Slopes range from 2 to 20 percent.

Typical pedon of Crider silt loam, 5 to 9 percent slopes, eroded, 1,250 feet south and 1,950 feet east of the northwest corner of sec. 27, T. 44 N., R. 1 W.

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silt loam, pale brown (10YR 6/3) dry; moderate very fine granular structure; friable; neutral; abrupt smooth boundary.
Bt1—7 to 17 inches; dark brown (7.5YR 4/4) silty clay loam; moderate very fine subangular blocky structure; firm; many fine roots; few faint clay films on faces of peds; medium acid; gradual smooth boundary.
Bt2—17 to 33 inches; dark brown (7.5YR 4/4) silty clay loam; few fine distinct dark yellowish brown (10YR 4/4) and brown (10YR 5/3) mottles; weak medium prismatic structure parting to moderate very fine subangular blocky; firm; common fine roots; many distinct clay films on faces of peds; medium acid; clear smooth boundary.
2Bt3—33 to 42 inches; yellowish red (5YR 5/6) silty clay loam; common fine faint reddish brown (5YR 4/4) and prominent brown (10YR 5/3) mottles; weak medium prismatic structure parting to moderate very fine subangular blocky; firm; common fine roots; few faint clay films on faces of peds; strongly acid; gradual smooth boundary.
2Bt4—42 to 52 inches; yellowish red (5YR 5/6) silty clay loam; common fine faint reddish brown (5YR 4/4) and prominent brown (10YR 5/3) mottles; weak medium prismatic structure parting to weak fine subangular blocky; firm; common dark brown stains; common prominent clay films on faces of peds; few angular chert fragments; strongly acid; gradual smooth boundary.
2Bt5—52 to 62 inches; reddish brown (5YR 4/4) silty clay loam; common fine faint yellowish red (5YR 4/6) and few fine prominent dark yellowish brown (10YR 4/4) mottles; moderate medium subangular

blocky structure; firm; few fine roots; common black stains; common faint clay films on faces of peds; few angular chert fragments; slightly acid.

The solum is 60 or more inches thick. Depth to the 2B horizon ranges from 20 to 45 inches. The Ap horizon has hue of 7.5YR or 10YR and chroma of 3 or 4. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon has value of 4 or 5 and chroma of 4 to 6. The content of chert fragments in this horizon ranges from 0 to 15 percent.

Gasconade Series

The Gasconade series consists of shallow, somewhat excessively drained soils on uplands. These soils formed in dolomite and shale residuum. Permeability is moderately slow. Slopes range from 9 to 35 percent.

Typical pedon of Gasconade flaggy silty clay loam, in an area of Gasconade-Rock outcrop complex, 9 to 35 percent slopes; 1,600 feet east and 900 feet north of the southwest corner of sec. 8, T. 42 N., R. 3 W.

A—0 to 6 inches; very dark gray (10YR 3/1) flaggy silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate very fine subangular blocky structure; firm; many fine and medium roots; about 20 percent dolomite fragments about 1 inch thick and as much as 16 inches long; few chert fragments; neutral; clear smooth boundary.

Bw—6 to 15 inches; very dark brown (10YR 2/2) very flaggy silty clay, very dark grayish brown (10YR 3/2) dry; moderate very fine subangular blocky structure; firm; common fine roots; about 40 percent dolomite fragments about 1 inch thick and as much as 16 inches long; neutral; abrupt wavy boundary.

R—15 inches; hard, gray dolomite bedrock.

The thickness of the solum ranges from about 4 to 20 inches and commonly is about the same as the depth to bedrock. The content of coarse fragments ranges from 15 to 70 percent in the solum.

Gatewood Series

The Gatewood series consists of moderately deep, moderately well drained, slowly permeable soils on uplands. These soils formed in cherty sediments and in the underlying clayey material or dolomite and shale residuum. Slopes range from 14 to 35 percent.

Typical pedon of Gatewood cherty silt loam, 14 to 20 percent slopes, 2,200 feet south and 800 feet west of the northeast corner of sec. 2, T. 42 N., R. 1 W.

A—0 to 3 inches; brown (10YR 4/3) cherty silt loam, pale brown (10YR 6/3) dry; moderate very fine granular structure; very friable; many fine roots; about 20 percent chert fragments; few sandstone fragments; medium acid; clear smooth boundary.

E—3 to 9 inches; brown (10YR 5/3) cherty silt loam; weak very fine granular structure; friable; common fine roots; about 25 percent chert and sandstone fragments; strongly acid; clear smooth boundary.

Bt—9 to 24 inches; dark brown (7.5YR 4/4) clay; few fine prominent yellowish red (5YR 4/6) mottles; moderate very fine subangular blocky structure; firm; few fine roots; about 5 percent angular chert fragments; few faint clay films on faces of peds; medium acid; abrupt smooth boundary.

2C—24 to 29 inches; dark yellowish brown (10YR 4/4) clay; massive; firm; about 5 percent chert fragments; neutral; abrupt smooth boundary.

2R—29 inches; hard dolomite bedrock.

The depth to hard dolomite bedrock ranges from 20 to 40 inches. The thickness of the solum ranges from about 18 to 36 inches. The Bt horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is clay or cherty clay.

Gladden Series

The Gladden series consists of very deep, well drained soils on small flood plains along streams. These soils formed in loamy alluvium and in the underlying cherty alluvium. Permeability is moderate in the upper part of the profile and rapid in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Gladden loam, 1,300 feet north and 150 feet east of the southwest corner of sec. 23, T. 43 N., R. 1 E.

Ap—0 to 7 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; moderate very fine granular structure; very friable; many fine roots; medium acid; abrupt smooth boundary.

A—7 to 12 inches; brown (10YR 4/3) loam; weak thin platy structure parting to moderate very fine granular; very friable; strongly acid; clear smooth boundary.

Bw1—12 to 20 inches; dark yellowish brown (10YR 4/4) loam; weak very fine subangular blocky structure;

friable; few fine roots; few chert fragments; very strongly acid; clear smooth boundary.
Bw2—20 to 32 inches; dark yellowish brown (10YR 4/4) loam; moderate very fine subangular blocky structure; friable; few fine roots; about 10 percent chert fragments; very strongly acid; clear smooth boundary.
2C—32 to 60 inches; brown (10YR 5/3) extremely cherty sandy loam; single grain; loose; few fine roots; about 75 percent chert fragments; very strongly acid.

The thickness of the solum ranges from 30 to 48 inches. Typically, the content of chert fragments ranges from 0 to 15 percent in the A and Bw horizons and from 50 to 80 percent in the C horizon.

Goss Series

The Goss series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in cherty and clayey material or in cherty dolomite residuum. Slopes range from 9 to 45 percent.

Typical pedon of Goss cherty silt loam, 14 to 45 percent slopes, 1,300 feet east and 400 feet south of the northwest corner of sec. 30, T. 41 N., R. 1 W.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) cherty silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; friable; many fine roots; about 30 percent chert fragments; medium acid; abrupt smooth boundary.
E1—3 to 10 inches; pale brown (10YR 6/3) cherty silt loam; weak very fine granular structure; friable; common fine roots; about 30 percent chert fragments; strongly acid; clear smooth boundary.
E2—10 to 21 inches; yellowish brown (10YR 5/4) very cherty silt loam; weak fine subangular blocky structure; friable; few fine roots; about 40 percent chert fragments; strongly acid; clear smooth boundary.
Bt1—21 to 42 inches; red (2.5YR 4/6) very cherty clay; moderate very fine angular and subangular blocky structure; very firm; few fine roots; common distinct clay films on faces of peds; about 55 percent chert fragments; strongly acid; clear smooth boundary.
Bt2—42 to 60 inches; red (2.5YR 4/6) very cherty clay; common fine prominent yellowish brown (10YR 5/4) mottles; moderate fine and very fine subangular blocky structure; very firm; few fine roots; common distinct clay films on faces of peds; about 50 percent chert fragments; medium acid.

The thickness of the solum, or the depth to bedrock, is more than 60 inches. The A horizon is dominantly cherty silt loam, but the range includes silt loam. The Bt horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 4 to 6. The content of chert in this horizon ranges from about 40 to 90 percent.

Hartville Series

The Hartville series consists of very deep, somewhat poorly drained, slowly permeable soils on stream terraces along cutoff stream meanders. These soils formed in alluvium. Slopes range from 2 to 9 percent.

Typical pedon of Hartville silt loam, 2 to 5 percent slopes, 2,500 feet west and 2,500 feet north of the southeast corner of sec. 12, T. 42 N., R. 1 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate very fine granular structure; very friable; common fine roots; slightly acid; abrupt smooth boundary.
Bt1—8 to 17 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine prominent red (2.5YR 4/6) and yellowish red (5YR 4/8) mottles; few fine faint grayish brown (10YR 5/2) mottles in the lower part; moderate very fine subangular structure; firm; few fine roots; few faint clay films on faces of peds; strongly acid; clear smooth boundary.
Bt2—17 to 32 inches; brown (10YR 5/3) silty clay; common fine faint grayish brown (10YR 5/2) and distinct dark brown (7.5YR 4/4) mottles; moderate very fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; very strongly acid; clear smooth boundary.
Bt3—32 to 46 inches; mottled grayish brown (10YR 5/2), yellowish brown (10YR 5/4), and strong brown (7.5YR 5/8) silty clay loam; weak medium prismatic structure parting to weak fine subangular blocky; firm; few fine roots; few distinct clay films in old root channels; very strongly acid; clear smooth boundary.
Bt4—46 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; firm; few fine roots; few distinct clay films on faces of prisms; very strongly acid.

The solum is 60 or more inches thick. The content of coarse fragments ranges from 0 to 10 percent to a depth of about 48 inches and from 0 to 35 percent

below that depth. The Bt horizon has hue of 10YR or 7.5YR and chroma of 2 to 8.

Haymond Series

The Haymond series consists of very deep, well drained, moderately permeable soils on flood plains. These soils formed in silty alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Haymond silt loam, 4,000 feet north and 1,600 feet west of the southeast corner of sec. 19, T. 44 N., R. 2 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate very fine granular structure; very friable; mixed with brown (10YR 5/3) silt loam from the horizon below by cultivation; common fine roots; neutral; abrupt smooth boundary.

C1—10 to 49 inches; brown (10YR 5/3) silt loam; weak fine subangular blocky structure; friable; appears massive but has weak bedding planes; few fine roots; neutral; clear smooth boundary.

C2—49 to 60 inches; brown (10YR 5/3) silt loam; few fine distinct yellowish brown (10YR 5/8) mottles; appears massive but has weak bedding planes; friable; few fine roots; neutral.

The C horizon has value of 4 or 5 and chroma of 3 or 4. It is silt loam, loam, or fine sandy loam.

Haynie Series

The Haynie series consists of very deep, well drained, moderately permeable soils on the flood plains along the Missouri River. These soils formed in recently deposited alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Haynie very fine sandy loam, in an area of Haynie-Waldron complex; 1,400 feet east and 100 feet south of the northwest corner of sec. 9, T. 44 N., R. 1 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) very fine sandy loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; very friable; common fine roots; neutral; abrupt smooth boundary.

C1—8 to 48 inches; stratified dark grayish brown (10YR 4/2) and dark brown (10YR 4/3) silt loam; common fine faint brown (10YR 5/3) mottles; weak very fine granular structure; very friable; horizontal cleavage along thin lenses of finer or coarser textured material; slightly effervescent; mildly alkaline; abrupt smooth boundary.

C2—48 to 60 inches; dark grayish brown (10YR 4/2) very fine sandy loam; appears massive but has weak bedding planes; very friable; strongly effervescent; mildly alkaline.

The thickness of the solum is 6 to 10 inches and is the same as the thickness of the A horizon. This horizon is dominantly very fine sandy loam, but the range includes silt loam. The C horizon has value of 4 or 5.

Hobson Series

The Hobson series consists of very deep, moderately well drained soils on uplands. These soils formed in material weathered dominantly from sandstone. They have a fragipan. Permeability is moderate above the fragipan and slow in the pan. Slopes range from 5 to 14 percent.

Typical pedon of Hobson loam, 5 to 9 percent slopes, 700 feet north and 600 feet west of the southeast corner of sec. 29, T. 42 N., R. 1 W.

A—0 to 4 inches; dark brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; moderate very fine granular structure; very friable; many fine roots; medium acid; abrupt smooth boundary.

E—4 to 8 inches; brown (10YR 5/3) loam; weak thin platy structure parting to weak fine granular; friable; common fine roots; strongly acid; clear smooth boundary.

BE—8 to 11 inches; dark brown (7.5YR 4/4) clay loam; moderate very fine subangular blocky structure; friable; common fine roots; very strongly acid; clear smooth boundary.

Bt—11 to 22 inches; strong brown (7.5YR 5/6) clay loam; moderate very fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; very strongly acid; clear smooth boundary.

2Ex1—22 to 38 inches; mixed brown (10YR 5/3) and yellowish brown (10YR 5/6) loam; common fine distinct grayish brown (10YR 5/2) mottles; weak thick platy structure; very firm; brittle; few fine chert fragments; very strongly acid; gradual smooth boundary.

2Ex2—38 to 60 inches; mixed brown (10YR 5/3) and yellowish brown (10YR 5/6) loam; common fine and medium distinct grayish brown (10YR 5/2) mottles;

massive; very firm; brittle; about 10 percent chert and sandstone fragments; very strongly acid.

The thickness of the solum, or the depth to hard sandstone bedrock, is more than 60 inches. Depth to the fragipan is 20 to 26 inches. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6.

Hodge Series

The Hodge series consists of very deep, somewhat excessively drained, rapidly permeable soils on the flood plains along the Missouri River. These soils formed in sandy recent alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Hodge fine sand, in an area of Hodge-Haynie complex; 1,400 feet north and 150 feet east of the southwest corner of sec. 4, T. 44 N., R. 1 W.

A—0 to 6 inches; dark brown (10YR 4/3) fine sand, pale brown (10YR 6/3) dry; single grain; loose; slightly effervescent; mildly alkaline; abrupt smooth boundary.

C1—6 to 30 inches; brown (10YR 5/3) fine sand, pale brown (10YR 6/3) dry; single grain; loose; few thin strata of loamy very fine sand; slightly effervescent; mildly alkaline; abrupt smooth boundary.

C2—30 to 60 inches; brown (10YR 5/3) fine sand; single grain; loose; few thin strata of loamy very fine sand; slightly effervescent; mildly alkaline.

The thickness of the solum is 3 to 10 inches and is the same as the thickness of the A horizon. The C horizon typically is fine sand, but many pedons have thin strata of finer or coarser textured material.

Holstein Series

The Holstein series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in loamy colluvial material or sandstone residuum. Slopes range from 14 to 35 percent.

Typical pedon of Holstein loam, in an area of Lily-Holstein-Ramsey loams, 14 to 35 percent slopes; 4,100 feet east and 1,450 feet north of the southwest corner of sec. 2, T. 41 N., R. 1 E.

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

E—4 to 9 inches; yellowish brown (10YR 5/4) loam; weak very fine granular structure; very friable; common fine roots; few chert fragments; medium acid; clear smooth boundary.

BE—9 to 18 inches; strong brown (7.5YR 4/6) loam; moderate very fine subangular blocky structure; friable; common fine roots; about 5 percent chert fragments; medium acid; clear smooth boundary.

Bt1—18 to 42 inches; dark brown (7.5YR 4/4) clay loam; moderate very fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; about 5 percent chert fragments; very strongly acid; gradual smooth boundary.

Bt2—42 to 51 inches; dark brown (7.5YR 4/4) clay loam; common fine distinct brown (10YR 5/3) mottles; moderate very fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; about 10 percent chert fragments; strongly acid; clear smooth boundary.

Bt3—51 to 65 inches; dark brown (7.5YR 4/4) clay loam; common fine faint dark brown (7.5YR 3/4) mottles; moderate very fine subangular blocky structure; firm; common faint clay films on faces of peds; about 5 percent chert fragments; very strongly acid.

The solum is more than 60 inches thick. The content of coarse fragments of sandstone and chert ranges from 0 to about 10 percent throughout the profile. The Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, clay loam, or sandy clay loam.

Lily Series

The Lily series consists of moderately deep, well drained soils on uplands. These soils formed in loamy material weathered from acid sandstone. Permeability is moderately rapid. Slopes range from 9 to 35 percent.

Typical pedon of Lily loam, in an area of Lily-Holstein-Ramsey loams, 14 to 35 percent slopes; 1,300 feet north and 1,300 feet west of the southeast corner of sec. 2, T. 41 N., R. 1 E.

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

E—3 to 7 inches; brown (10YR 5/3) loam; weak very fine granular structure; very friable; many fine and medium roots; about 5 percent chert fragments; very strongly acid; clear smooth boundary.
BE—7 to 12 inches; brown (7.5YR 4/4) loam; moderate very fine subangular blocky structure; friable; common fine roots; about 5 percent chert fragments; very strongly acid; clear smooth boundary.
Bt1—12 to 20 inches; yellowish red (5YR 5/6) sandy clay loam; moderate very fine subangular blocky structure; firm; common fine roots; about 5 percent chert fragments; few faint clay films on faces of peds; very strongly acid; gradual smooth boundary.
Bt2—20 to 29 inches; yellowish red (5YR 4/6) sandy clay loam; moderate very fine subangular blocky structure; firm; few fine roots; about 10 percent chert fragments; about 5 percent weathered sandstone fragments; few faint clay films on faces of peds; very strongly acid; abrupt smooth boundary.
R—29 inches; hard, red and yellow sandstone bedrock.

The thickness of the solum, or the depth to acid sandstone bedrock, ranges from 20 to 40 inches. The content of coarse fragments of sandstone or chert ranges from 0 to 10 percent in the A and E horizons and from 0 to 35 percent in the B horizon. The B horizon has hue of 5YR or 7.5YR and chroma of 4 to 6.

Menfro Series

The Menfro series consists of very deep, well drained, moderately permeable soils on uplands and high terraces. These soils formed in thick deposits of loess. Slopes range from 2 to 35 percent.

Typical pedon of Menfro silt loam, 5 to 9 percent slopes, eroded, in a road cut along the south side of old Highway 100, about 650 feet west of the east boundary of Survey 404:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate very fine granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.
Bt1—6 to 10 inches; dark yellowish brown (10YR 4/4) silt loam; moderate very fine subangular blocky structure; friable; common fine roots; slightly acid; clear smooth boundary.
Bt2—10 to 16 inches; dark brown (7.5YR 4/4) silty clay loam; moderate very fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; medium acid; clear smooth boundary.
Bt3—16 to 27 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium prismatic structure parting to moderate very fine subangular blocky; firm; common faint clay films on faces of peds; medium acid; gradual smooth boundary.
Bt4—27 to 38 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium prismatic structure parting to moderate very fine subangular blocky; firm; few fine roots; few faint clay films on faces of prisms; medium acid; gradual smooth boundary.
Bt5—38 to 54 inches; dark brown (7.5YR 4/4) silty clay loam; weak fine subangular blocky structure; friable; few faint clay films coating some root channels; slightly acid; gradual smooth boundary.
C—54 to 72 inches; dark brown (7.5YR 4/4) silt loam; massive; friable; slightly acid.

The solum typically is 50 or more inches thick. The Ap horizon dominantly is silt loam, but it is silty clay loam in some eroded areas. The Bt horizon has chroma of 3 or 4.

Midco Series

The Midco series consists of very deep, somewhat excessively drained soils on flood plains along small streams. These soils formed in cherty alluvium. Permeability is moderately rapid. Slopes range from 0 to 2 percent.

Typical pedon of Midco cherty sandy loam, in an area of Gladden-Midco complex; 100 feet north and 1,800 feet west of the southeast corner of sec. 31, T. 42 N., R. 1 W.

A—0 to 7 inches; dark brown (10YR 3/3) cherty sandy loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine and medium roots; about 30 percent chert fragments; medium acid; clear wavy boundary.
C1—7 to 21 inches; brown (10YR 4/3) extremely cherty loam; massive; very friable; few fine and medium roots; about 60 percent chert fragments; strongly acid; clear wavy boundary.
C2—21 to 60 inches; dark brown (7.5YR 4/4) extremely cherty loam; massive; very friable; few fine roots; about 75 percent chert fragments; strongly acid.

The solum is 3 to 10 inches thick. The content of chert ranges from 10 to 35 percent in the A horizon and from 35 to 85 percent in the C horizon.

Pope Series

The Pope series consists of very deep, well drained, moderately permeable soils on stream terraces and flood plains. These soils formed in loamy alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Pope loam, 700 feet east and 650 feet north of the southwest corner of sec. 20, T. 42 N., R. 1 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; moderate very fine granular structure; very friable; common fine roots; slightly acid; abrupt smooth boundary.

A—9 to 12 inches; dark yellowish brown (10YR 3/4) loam; moderate very fine granular structure; very friable; common fine roots; slightly acid; clear smooth boundary.

Bw1—12 to 32 inches; dark brown (7.5YR 4/4) loam; common fine distinct dark yellowish brown (10YR 3/4) mottles; moderate fine subangular blocky structure; very friable; strongly acid; gradual smooth boundary.

Bw2—32 to 46 inches; dark brown (7.5YR 4/4) loam; moderate fine subangular blocky structure; very friable; strongly acid; gradual smooth boundary.

C—46 to 60 inches; dark brown (7.5YR 4/4) loam; massive; very friable; strongly acid.

The thickness of the solum ranges from 30 to 50 inches. The content of chert pebbles ranges from 0 to 15 percent in the solum and from 0 to about 35 percent in the C horizon. The A horizon has value of 2 to 5 and chroma of 2 to 4. It is dominantly loam, but the range includes fine sandy loam.

Racoon Series

The Racoon series consists of very deep, poorly drained, slowly permeable soils on low stream terraces and foot slopes. These soils formed in loess and in the underlying silty alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Racoon silt loam, 0 to 3 percent slopes, 400 feet east and 3,100 feet north of the southwest corner of sec. 3, T. 42 N., R. 1 W.

Ap1—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate very fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Ap2—8 to 12 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; common fine faint brown (10YR 4/3) mottles; weak thin platy structure parting to weak fine granular; friable; common fine roots; medium acid; clear smooth boundary.

E1—12 to 24 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium platy structure parting to weak fine granular; friable; common roots; common fine concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

E2—24 to 32 inches; light brownish gray (10YR 6/2) silt loam; common fine faint light gray (10YR 7/2) and distinct yellowish brown (10YR 5/4) mottles; weak medium platy structure parting to weak fine granular; friable; slightly brittle; common fine concretions of iron and manganese oxide surrounded by dark brown stains; strongly acid; clear smooth boundary.

Btg1—32 to 47 inches; light brownish gray (2.5Y 6/2); silty clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; moderate very fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; common fine pockets of white silt; common fine concretions of iron and manganese oxide; common black stains; very strongly acid; clear smooth boundary.

Btg2—47 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium distinct brown (10YR 5/3) and few fine prominent yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; firm; few fine roots; common distinct clay films lining pores; strongly acid.

The solum is 60 or more inches thick. Depth to the Btg horizon ranges from 24 to 36 inches. The A1 or Ap horizon has value of 4 or 5. The E horizon has value of 4 to 7 and chroma of 1 or 2. The Btg horizon has hue of 10YR or 2.5Y and chroma of 1 or 2.

Ramsey Series

The Ramsey series consists of shallow, somewhat excessively drained, rapidly permeable soils on uplands. These soils formed in material weathered from acid sandstone. Slopes range from 9 to 35 percent.

Typical pedon of Ramsey loam, in an area of Lily-Holstein-Ramsey loams, 14 to 35 percent slopes; 1,250 feet north and 4,050 feet east of the southwest corner of sec. 2, T. 41 N., R. 1 E.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; moderate very fine granular structure; very friable; many fine roots; few fine chert fragments; strongly acid; abrupt smooth boundary.
E—3 to 6 inches; brown (10YR 4/3) loam; weak very fine granular structure; very friable; common fine roots; about 5 percent chert and sandstone fragments; very strongly acid; clear smooth boundary.
Bw1—6 to 12 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; common fine roots; about 10 percent chert and sandstone fragments; very strongly acid; clear smooth boundary.
Bw2—12 to 16 inches; brown (10YR 5/3) sandy loam; weak fine subangular blocky structure; friable; about 10 percent chert and sandstone fragments; very strongly acid; abrupt smooth boundary.
R—16 inches; hard sandstone bedrock.

The thickness of the solum, or the depth to acid sandstone bedrock, ranges from 10 to 20 inches. The content of coarse fragments of sandstone or chert ranges from about 5 to 15 percent throughout the profile. The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6.

Twomile Series

The Twomile series consists of very deep, poorly drained, slowly permeable soils on stream terraces. These soils formed in loess and in the underlying silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Twomile silt loam, 2,600 feet south and 900 feet west of the northeast corner of sec. 16, T. 44 N., R. 3 W.

Ap—0 to 12 inches; brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; moderate very fine granular structure; very friable; common roots; neutral; abrupt smooth boundary.
E—12 to 18 inches; light brownish gray (10YR 6/2) silt; weak thick platy structure; friable; somewhat brittle; few medium and fine roots; common fine pores or voids; common fine and medium concretions of iron and manganese oxide; common dark brown stains; medium acid; clear smooth boundary.
Ex—18 to 30 inches; light brownish gray (10YR 6/2) silt; few fine distinct yellowish brown (10YR 5/6) mottles; weak thick platy structure; firm; weakly or moderately expressed brittleness; compact; few fine roots; common fine pores or voids; common fine and medium concretions of iron and manganese oxide; common dark brown stains; medium acid; abrupt smooth boundary.
Bt1—30 to 44 inches; grayish brown (10YR 5/2) silty clay loam; few fine distinct dark yellowish brown (10YR 3/4) mottles; moderate medium prismatic structure parting to moderate very fine subangular blocky; firm; few fine roots; few faint clay films on faces of peds; common coatings on peds and fine pockets of white silt; common pores; common fine concretions of iron and manganese oxide and dark brown stains; very strongly acid; clear smooth boundary.
Bt2—44 to 53 inches; grayish brown (10YR 5/2) silt loam; few fine distinct dark yellowish brown (10YR 3/4) mottles; weak fine subangular blocky structure; firm; faint clay films in a few old root channels; common fine concretions of iron and manganese oxide; very strongly acid; clear smooth boundary.
C—53 to 60 inches; mottled grayish brown (10YR 5/2), light brownish gray (10YR 6/2), and dark yellowish brown (10YR 4/4) silt loam; massive; friable; common fine concretions of iron and manganese oxide; common fine pores or voids; strongly acid.

Depth to the brittle and compact Ex horizon is 15 to 20 inches. Depth to the Bt horizon is 26 to 32 inches. The E and Ex horizons have value of 5 or 6 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It has mottles with higher chroma. The content of clay in this horizon is more than 24 percent.

Union Series

The Union series consists of very deep, moderately well drained soils on uplands. These soils formed in sequential layers of loess, cherty sediments, clayey material, and sandstone residuum. They have a fragipan. Permeability is moderate in the upper part of the profile, slow in the fragipan, and moderately slow below the pan. Slopes range from 2 to 14 percent.

Typical pedon of Union silt loam, 2 to 5 percent slopes, eroded, 2,600 feet north and 1,150 feet west of the southeast corner of sec. 10, T. 42 N., R. 2 W.

Ap—0 to 5 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate very fine granular structure; very friable; many fine roots; medium acid; abrupt smooth boundary.

BE—5 to 9 inches; yellowish brown (10YR 5/4) silty clay loam; weak fine granular structure; friable; many fine roots; very strongly acid; clear smooth boundary.
Bt1—9 to 16 inches; strong brown (7.5YR 5/6) silty clay; moderate very fine subangular blocky structure; firm; few faint clay films on faces of peds; few fine roots; very strongly acid; clear smooth boundary.
Bt2—16 to 21 inches; dark brown (7.5YR 4/4) silty clay; common medium distinct yellowish brown (10YR 5/4) mottles; moderate very fine subangular blocky structure; firm; few faint clay films on faces of peds; few fine roots; very strongly acid; clear smooth boundary.
Bt3—21 to 30 inches; dark brown (7.5YR 4/4) silty clay loam; common fine distinct brown (10YR 5/3) and few fine distinct grayish brown (10YR 5/2) mottles; moderate very fine subangular blocky structure; firm; few faint clay films on faces of peds; few fine roots; very strongly acid; clear smooth boundary.
Bx—30 to 45 inches; dark yellowish brown (10YR 4/4) silt loam; common medium distinct grayish brown (10YR 5/2) mottles in patches and vertical bands; massive; very hard; brittle; few chert fragments; very strongly acid; clear smooth boundary.
2Ex—45 to 51 inches; brown (10YR 5/3) very cherty silt loam; few fine distinct light brownish gray (10YR 6/2) mottles; massive; very firm; brittle; about 55 percent chert fragments; very strongly acid; abrupt wavy boundary.
2Bt—51 to 60 inches; yellowish brown (10YR 5/6) clay; many fine and medium prominent red (2.5YR 4/6) and few fine distinct brown (10YR 5/3) mottles; weak very fine subangular structure; firm; few faint clay films on faces of peds; about 10 percent chert fragments; strongly acid.

The thickness of the solum, or the depth to bedrock, is more than 60 inches. Depth to the fragipan is 28 to 32 inches in most areas but ranges from 26 to 34 inches. Depth to the 2Bt horizon ranges from about 45 to 55 inches. Some pedons have an E horizon. The Bt horizon has hue of 7.5YR or 10YR. The content of chert fragments in the Bx horizon ranges from 0 to 10 percent.

Waldron Series

The Waldron series consists of very deep, somewhat poorly drained, slowly permeable soils on the flood plains along the Missouri River. These soils formed in silty and clayey alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Waldron silty clay, in an area of Waldron-Booker silty clays; 4,200 feet north and 1,400 feet east of the southwest corner of sec. 26, T. 44 N., R. 1 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; firm; few fine roots; slightly effervescent; mildly alkaline; abrupt smooth boundary.
C1—9 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam; few fine prominent yellowish brown (10YR 5/8) mottles; weak very fine subangular blocky structure; firm; common thin lenses of brown silt; slightly effervescent; moderately alkaline; abrupt smooth boundary.
C2—22 to 37 inches; dark gray (10YR 4/1) silty clay; moderate fine angular blocky structure; firm; common red stains on faces of some peds; slightly effervescent; moderately alkaline; clear smooth boundary.
C3—37 to 60 inches; dark grayish brown (10YR 4/2) silty clay; common medium faint very dark gray (10YR 3/1) mottles; massive; firm; common thin lenses of brown, silty material; slightly effervescent; moderately alkaline.

The thickness of the solum is 6 to 9 inches and is the same as the thickness of the Ap horizon. Free carbonates are throughout the profile. Thin strata of coarser or finer textured material are common in many pedons. The content of clay in the 10- to 40-inch control section ranges from 35 and 50 percent.

Winfield Series

The Winfield series consists of very deep, moderately well drained, moderately permeable soils on uplands. These soils formed in thick deposits of loess. Slopes range from 5 to 14 percent.

Typical pedon of Winfield silt loam, 5 to 9 percent slopes, eroded, 2,900 feet west and 500 feet south of the northeast corner of sec. 25, T. 44 N., R. 2 E.

Ap—0 to 5 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; moderate very fine granular structure; very friable; many fine roots; medium acid; abrupt smooth boundary.
Bt1—5 to 9 inches; dark yellowish brown (10YR 4/4) silt loam; moderate very fine subangular blocky structure; friable; common fine roots; few faint clay

films on faces of peds; medium acid; clear smooth boundary.

Bt2—9 to 19 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate very fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt3—19 to 30 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine distinct grayish brown (10YR 5/2) and common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate very fine subangular blocky; firm; few fine roots; common faint clay films on faces of prisms; strongly acid; gradual smooth boundary.

Bt4—30 to 48 inches; dark brown (7.5YR 4/4) silty clay loam; common fine prominent grayish brown (10YR 5/2) and faint strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; firm; few fine roots; few faint clay films on faces of prisms; very strongly acid; clear smooth boundary.

C—48 to 67 inches; dark brown (7.5YR 4/4) silt loam; many fine and medium distinct grayish brown (10YR 5/2) mottles; massive; friable; medium acid.

The solum is more than 40 inches thick. The Ap horizon is dominantly silt loam, but the range includes silty clay loam.

Formation of the Soils

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material accumulated; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material. Human activities also affect soil formation.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the transformation of the parent material into a soil. Generally, a long time is required for the development of distinct horizons. The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the others.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. The accumulation or deposition of this material is the first step in the development of a soil profile. The characteristics of this material affect the chemical and mineralogical composition of the soil. The parent materials in Franklin County are residuum, or material weathered from bedrock; loess, or silty wind-deposited material; alluvium, or water-deposited material on flood plains; and colluvium, or material transported by gravity and water.

The residual material in Franklin County is derived from sedimentary rocks, mainly dolomite and sandstone formations of the Ordovician System *(7)*. Other important sources are clays and the associated sandstone and clastic rocks of the Pennsylvanian System; Burlington limestone of the Mississippian System, in the northeast corner of the county; and some Eminence dolomite of the Cambrian System, in the extreme southern part.

The dolomite in the county varies in content of chert. Material weathered from cherty dolomite of the Gasconade Formation probably is the principal parent material of Goss soils, although some studies attribute the origin of this material to submarine volcanism and volcanic ash deposition *(3, 10)*. Gatewood and Gasconade soils formed principally in the less cherty, argillaceous residuum of the Jefferson City Formation.

Hobson, Holstein, Lily, and Ramsey soils formed mainly in sandstone residuum of the Roubideaux Formation. This sandstone occurs most prominently as a band extending past the middle of the county from the south corners and occurs elsewhere in a random pattern of anticlinal structures. This roughly defined arc forms a segment of the annular pattern surrounding the Ozark dome, where older formations have been raised to positions above those of younger age by the Ozark uplift. The Gasconade and Eminence Formations also are parts of this annular pattern.

The youngest sources of the residual parent material in the county are Pennsylvanian clays, sandstone, and shale and the associated surficial chert of obscure origin. These rocks lie unconformably on eroded surfaces of the Ordovician System, primarily that of Jefferson City dolomite *(7)*. Filled sink deposits of refractory clays are common at the contact point of these systems. Many of these "clay pits" have been mined. Sandstone rimrock commonly is associated with these filled sinks. Beemont soils and the lower part of the solum in Union soils formed in deposits of clay or in material weathered from these rocks and the associated surficial chert.

Loess probably once mantled all of the survey area. It was deposited during the most recent postglacial period. The sources of this material were the flood plains along the Missouri River and its tributaries.

Choked with sediment deposited by glacial meltwater and nearly barren in the still frigid climate, these valleys were the focus of violent duststorms. The resulting deposits blanketed the landscape to depths that were greatest on the river hills and decreased with distance from the source. Erosion removed the loess at widely varying rates. It must have nearly kept pace with deposition on the steep, sun-warmed south exposures, where stripping has been complete. North aspects, in contrast, remained frozen longer and retained an appreciable amount of the loess. The thickness of the loess on the more stable landforms ranges from about 20 inches to 10 feet.

Menfro soils formed in thick deposits of loess. The upper part of Bucklick, Crider, and Union soils on uplands and the upper part of Auxvasse and Twomile soils on stream terraces formed in loess. Stone lines associated with a fragipan in the Union soils mark the contact between different kinds of material and suggest the genetic history of the area *(10)*.

The pattern of loess distribution indicates that no major alterations of landforms have occurred since the loess was deposited *(3)*. Subsequent geologic erosion has had little effect on the landscape, although it has removed some surficial material, dominantly loess.

The soils on the flood plains in Franklin County formed in alluvial deposits about 3 to more than 30 feet thick. These soils differ widely in texture and chemical composition, reflecting a diversity of origin, varying speeds of floodwater, and various kinds of primary source material. The soils on the flood plains along the Missouri River, which have a vast watershed as their source of material, are rich in unweathered minerals. They differ from one another in texture. Booker and Waldron soils, for example, formed in clayey deposits in slack-water areas. Hodge soils formed in sandy material deposited by swift currents.

The soils on the smaller flood plains, namely those along the Meramec and Bourbeuse Rivers and those along creeks and branches, formed mainly in silty and loamy alluvium. The basal deposits commonly are gravel, and the soil particles or coarse fragments decrease in size toward the surface *(3)*. A similar gradation occurs as the distance downstream increases. The cherty Cedargap and Midco soils, for example, are on narrow upstream reaches, and the silty Haymond soils dominate the broader flood plains. The relatively rapid accumulation of loess as a source material and a decrease in stream velocity are among the causes of this gradation *(3)*.

The Holstein soils on foot slopes below sandstone outcrops are examples of soils that formed in colluvium. This material was moved short distances downslope by gravity and water.

Climate

Climate has been an important factor affecting soil formation in Franklin County. The county has a subhumid midcontinental climate marked by distinct seasonal temperature changes and a predictable distribution of rainfall. As a result of the climate in past ages, parent material was deposited by water and wind. Since the time of deposition, the climate has affected the soils that formed in this material. Changes in the abundance and species of plants and animals are determined by changes in climate. The current climatic conditions favor the growth of trees at the expense of prairie grasses.

High temperatures and rainfall result in chemical changes and physical disintegration. Calcium carbonates and other soluble salts are removed by leaching, the level of fertility decreases, and silicate clays form and are translocated. Nearly all the soils on uplands in Franklin County show these climatic effects.

The influence of the regional climate on soil formation is modified in many places by local conditions. For example, the shallow, strongly sloping to steep Gasconade soils on south-facing slopes formed under the influence of a microclimate that is warmer and less humid than that of the deep Bucklick soils on north-facing slopes.

Living Organisms

The living organisms that influence soil formation include plants, burrowing animals, worms and insects in the soil, bacteria, and fungi. Among the soil properties affected are the content of organic matter and nitrogen, reaction, color, structure, and porosity.

The composition of plant communities varies, depending on the climate and the depth, fertility level, available water capacity, and drainage class of the soil. The organic matter added to Union and other soils that formed under forest vegetation is derived mainly from leaves, twigs, and logs, which decompose at the surface. These materials tend to be acid. The forest soils have a thin, dark surface layer and a leached subsurface layer.

In contrast, the organic matter added to soils that formed under prairie grasses is derived mainly from the decay of annual and biennial plants. A large part of this material is in the form of roots at various depths, and the material thus added tends to be higher in mineral content than the forest residue. As a result, Bremer and

other soils that formed under prairie grasses tend to be less acid than the soils that formed under forest vegetation. Also, the dark surface layer is much thicker.

The soils that formed under grasses make up only a small acreage in Franklin County. Because the rainfall was adequate for forest vegetation, prairie grasses were limited to areas that were too wet or too dry for trees. Examples are the swamps in ponded areas of Booker soils and the grassy glades in areas of the shallow Gasconade soils.

Micro-organisms play an important part in the decomposition of plant residue. By reducing the plant material to humus, they release plant nutrients, enhance soil structure, and improve the physical condition of the surface layer. The properties that favor biological activity in the soil are a high content of organic matter, medium acid to neutral reaction, good aeration, low bulk density, and medium texture.

Since the time of settlement, human activities have affected soil formation. Some of these effects have been drastic. Removal of trees and cultivation, for example, have influenced soil formation. In many places cultivation has mixed the surface layer with the subsurface layer, lowered the content of organic matter, inhibited biological activity, and increased the runoff rate and the hazard of erosion. In places erosion has removed the original surface layer, lowering the fertility level and productivity of the soil.

Relief

Relief refers to the general unevenness of the land surface, the variations in elevation, and the nature of the slopes between one elevation and another. It is an important factor in determining the pattern and distribution of soils on a landscape because of its influence on drainage, runoff, erosion, and microclimate.

The difference in elevation from a ridgetop to the adjacent valley floor varies from one landform to another. Relief is highest, about 300 feet, in the steep, hilly region in the northeast corner of the county and in the vicinity of Meramec State Park, along the southern boundary of the county.

Relief results from natural forces that create inequalities in the land surface. In Franklin County the streams that carry runoff from the flanks of the Ozark uplift have incised through dolomite and sandstone bedrock, creating entrenched and meandering stream valleys. For the most part, elevation differences decrease as these streams approach confluences with larger streams.

Runoff is slower on Hobson and Union soils than on the steeper soils. As a result, more water generally penetrates the surface. This additional water intensifies leaching, the translocation of clay, and other soil-forming processes. On the steeper soils, runoff is excessive and soil formation is retarded. The removal of weathered products by geologic erosion nearly keeps pace with the accumulation of soil material through weathering. Gasconade and Ramsey soils formed under these conditions.

Time

Time is necessary for the various processes of soil formation to act upon the parent material. The time needed may be quite short or very long. The age of a soil is expressed in profile characteristics. It is not an absolute function of time. Rather, it is the result of the interaction among the other factors of soil formation over periods of time. The effects of time are conditioned by topography and climate.

The soils in Franklin County show a wide range in age. Those that formed in recent alluvial deposits, such as the Hodge and Blake soils on the flood plains along the Missouri River, are among the youngest soils in the county. In areas of the shallow, strongly sloping to steep Gasconade soils, the removal of soil material through geologic erosion almost keeps pace with the accumulation of that material through weathering, keeping these soils relatively young.

Union and other soils that formed in loess and in the underlying material on broad ridgetops are the oldest soils in the county. The greater age of these soils is indicated by a number of profile features. The carbonates that originally were in the parent material have been leached out of the profile, leaving the soils quite acid. Clay has been concentrated in a distinct subsoil through weathering and through the translocation caused by percolating water. A fragipan, which is thought to be indicative of age, has formed in these soils.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together in 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.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and 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.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

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 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

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.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

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

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

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.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly

nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts 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 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.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

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 ensure 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 (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the 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.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single 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.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts 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.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

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.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Union, 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*	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-----	40.9	19.3	30.1	72	-12	12	1.71	0.62	2.61	5	5.3
February----	46.4	23.5	35.0	75	-5	21	2.08	1.01	3.01	5	4.8
March-------	56.3	32.0	44.2	85	5	78	3.14	1.83	4.31	7	4.9
April-------	69.8	43.7	56.8	90	22	229	3.65	2.09	5.03	8	.5
May---------	77.6	51.7	64.7	92	30	456	4.26	2.43	5.88	8	.0
June--------	86.1	60.7	73.4	99	42	702	4.11	1.50	6.28	6	.0
July--------	90.5	65.2	77.9	104	49	865	3.86	1.55	5.79	6	.0
August------	89.1	63.1	76.1	103	46	809	3.10	1.66	4.35	6	.0
September---	82.4	55.0	68.7	98	35	561	3.07	1.08	4.72	5	.0
October-----	71.0	43.3	57.2	91	23	243	2.81	1.43	4.01	5	.0
November----	56.3	33.0	44.7	82	9	35	2.59	1.10	3.86	5	1.7
December----	45.3	24.9	35.1	73	-3	7	2.27	.83	3.47	5	2.8
Yearly:											
Average---	67.6	43.0	55.3	---	---	---	---	---	---	---	---
Extreme---	---	---	---	106	-13	---	---	---	---	---	---
Total-----	---	---	---	---	---	4,018	36.65	28.70	43.93	71	20.0

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Union, Missouri)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 13	Apr. 26	May 11
2 years in 10 later than--	Apr. 8	Apr. 21	May 6
5 years in 10 later than--	Mar. 30	Apr. 11	Apr. 25
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 18	Oct. 6	Sept. 28
2 years in 10 earlier than--	Oct. 23	Oct. 12	Oct. 3
5 years in 10 earlier than--	Nov. 2	Oct. 22	Oct. 12

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Union, Missouri)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	197	174	150
8 years in 10	203	180	156
5 years in 10	216	193	169
2 years in 10	229	206	181
1 year in 10	236	213	187

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1B2	Union silt loam, 2 to 5 percent slopes, eroded	12,400	2.1
1C2	Union silt loam, 5 to 9 percent slopes, eroded	50,090	8.4
1D2	Union silt loam, 9 to 14 percent slopes, eroded	20,510	3.4
2D	Goss cherty silt loam, 9 to 14 percent slopes	9,770	1.6
2F	Goss cherty silt loam, 14 to 45 percent slopes	40,935	6.9
3	Twomile silt loam	7,095	1.2
5B	Hartville silt loam, 2 to 5 percent slopes	8,145	1.4
5C	Hartville silt loam, 5 to 9 percent slopes	10,700	1.8
6B	Bucklick silt loam, 2 to 5 percent slopes	915	0.2
6C	Bucklick silt loam, 5 to 9 percent slopes	19,975	3.4
6D	Bucklick silt loam, 9 to 14 percent slopes	30,910	5.2
6E	Bucklick silt loam, 14 to 20 percent slopes	15,220	2.6
6F	Bucklick-Gatewood complex, 20 to 35 percent slopes	1,415	0.2
7B	Menfro silt loam, 2 to 5 percent slopes	2,160	0.4
7C2	Menfro silt loam, 5 to 9 percent slopes, eroded	8,480	1.4
7D2	Menfro silt loam, 9 to 14 percent slopes, eroded	10,995	1.9
7E2	Menfro silt loam, 14 to 20 percent slopes, eroded	3,780	0.6
7F	Menfro silt loam, 20 to 35 percent slopes	10,995	1.9
8B	Crider silt loam, 2 to 5 percent slopes	1,860	0.3
8C2	Crider silt loam, 5 to 9 percent slopes, eroded	20,140	3.4
8D2	Crider silt loam, 9 to 14 percent slopes, eroded	26,595	4.5
8E	Crider silt loam, 14 to 20 percent slopes	6,100	1.0
10F	Gasconade-Rock outcrop complex, 9 to 35 percent slopes	18,030	3.0
12	Bremer silty clay loam	1,915	0.3
13A	Auxvasse silt loam, 0 to 3 percent slopes	2,650	0.4
14C	Hobson loam, 5 to 9 percent slopes	25,180	4.2
14D	Hobson loam, 9 to 14 percent slopes	11,665	2.0
15	Gladden-Midco complex	20,350	3.4
16	Blake-Waldron complex	5,535	0.9
17	Hodge-Blake complex	2,330	0.4
19	Haynie-Waldron complex	2,630	0.4
20	Hodge-Haynie complex	1,080	0.2
22	Waldron-Booker silty clays	2,950	0.5
23C2	Winfield silt loam, 5 to 9 percent slopes, eroded	1,210	0.2
23D2	Winfield silt loam, 9 to 14 percent slopes, eroded	1,715	0.3
24E	Gatewood cherty silt loam, 14 to 20 percent slopes	25,335	4.3
25E	Beemont cherty silt loam, 9 to 20 percent slopes	25,305	4.3
29F	Menfro-Bardley silt loams, 20 to 50 percent slopes	6,180	1.0
31	Pits-Udorthents complex	780	0.1
32	Pits, quarries	875	0.1
36F	Bardley cherty silt loam, 20 to 50 percent slopes	4,895	0.8
38A	Haymond-Riverwash complex, 0 to 3 percent slopes	4,300	0.7
39	Haymond silt loam	31,880	5.4
40A	Racoon silt loam, 0 to 3 percent slopes	7,985	1.3
43	Cedargap cherty loam	5,640	1.0
44	Gladden loam	6,800	1.1
45	Pope loam	7,813	1.3
46F	Lily-Holstein-Ramsey loams, 14 to 35 percent slopes	21,260	3.6
47D	Lily-Hobson-Ramsey complex, 9 to 14 percent slopes	24,550	4.1
	Water	5,203	0.9
	Total	595,226	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
1B2	Union silt loam, 2 to 5 percent slopes, eroded
3	Twomile silt loam (where drained)
5B	Hartville silt loam, 2 to 5 percent slopes
6B	Bucklick silt loam, 2 to 5 percent slopes
7B	Menfro silt loam, 2 to 5 percent slopes
8B	Crider silt loam, 2 to 5 percent slopes
12	Bremer silty clay loam (where drained)
13A	Auxvasse silt loam, 0 to 3 percent slopes (where drained)
16	Blake-Waldron complex (where drained)
19	Haynie-Waldron complex (where drained)
22	Waldron-Booker silty clays (where drained)
39	Haymond silt loam
40A	Racoon silt loam, 0 to 3 percent slopes (where drained)
44	Gladden loam
45	Pope 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	Tall fescue-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	AUM*
1B2---------- Union	IIIe	60	26	68	40	3.7	6.6
1C2---------- Union	IVe	55	24	64	36	3.5	6.4
1D2---------- Union	VIe	---	---	---	---	3.2	5.6
2D---------- Goss	VIs	---	---	---	---	---	5.6
2F---------- Goss	VIIe	---	---	---	---	---	4.6
3---------- Twomile	IIIw	60	25	66	28	3.0	6.0
5B---------- Hartville	IIe	65	25	70	36	2.7	6.6
5C---------- Hartville	IIIe	55	20	68	34	2.7	5.4
6B---------- Bucklick	IIe	70	30	68	38	3.7	6.4
6C---------- Bucklick	IIIe	65	25	64	36	3.5	6.0
6D---------- Bucklick	IVe	60	20	60	32	3.2	5.4
6E---------- Bucklick	VIe	---	---	---	---	2.3	5.0
6F---------- Bucklick-Gatewood	VIIe	---	---	---	---	---	3.8
7B---------- Menfro	IIe	92	40	100	38	5.0	8.2
7C2---------- Menfro	IIIe	84	35	90	35	4.7	7.2
7D2---------- Menfro	IIIe	74	30	80	32	4.4	6.8
7E2---------- Menfro	IVe	63	25	70	22	4.2	6.0
7F---------- Menfro	VIe	---	---	---	---	---	5.4
8B---------- Crider	IIe	88	35	95	36	5.5	7.8

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Tall fescue-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	AUM*
8C2---------- Crider	IIIe	80	30	90	45	4.6	7.2
8D2---------- Crider	IIIe	70	25	80	40	4.2	6.6
8E---------- Crider	IVe	60	20	70	40	4.0	5.8
10F**---------- Gasconade-Rock outcrop	VIIs	---	---	---	---	---	---
12---------- Bremer	IIw	92	38	72	35	4.5	7.5
13A---------- Auxvasse	IIIw	85	31	72	35	4.5	7.4
14C---------- Hobson	IIIe	40	20	58	28	3.2	6.0
14D---------- Hobson	IVe	---	---	---	---	3.0	5.0
15---------- Gladden-Midco	IIIw	48	24	50	28	3.4	6.0
16---------- Blake-Waldron	IIw	120	38	---	40	4.7	6.5
17---------- Hodge-Blake	Vw	---	---	---	---	---	---
19---------- Haynie-Waldron	IIw	110	40	99	40	3.8	7.6
20---------- Hodge-Haynie	IIIs	80	36	60	30	3.9	7.2
22---------- Waldron-Booker	IIIw	80	31	60	30	2.5	5.0
23C2---------- Winfield	IIIe	92	36	90	40	4.2	8.0
23D2---------- Winfield	IIIe	82	32	80	35	3.8	7.4
24E---------- Gatewood	VIIs	---	---	---	---	---	3.0
25E---------- Beemont	VIIs	---	---	---	---	---	3.0
29F---------- Menfro-Bardley	VIIe	---	---	---	---	---	4.2
31. Pits-Udorthents							

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Tall fescue-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	AUM*
32**. Pits							
36F---------- Bardley	VIIe	---	---	---	---	1.5	3.0
38A**---------- Haymond-Riverwash	Vw	---	---	---	---	---	---
39---------- Haymond	IIw	110	39	90	42	5.0	8.0
40A---------- Racoon	IIIw	75	28	90	42	3.8	5.8
43---------- Cedargap	IIIw	45	20	60	30	3.0	5.8
44---------- Gladden	IIw	70	25	70	30	3.3	6.5
45---------- Pope	IIw	80	30	75	---	4.0	8.0
46F---------- Lily-Holstein-Ramsey	VIIe	---	---	---	---	---	4.5
47D---------- Lily-Hobson-Ramsey	VIe	---	---	---	---	---	4.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
1B2, 1C2, 1D2--- Union	3A	Slight	Slight	Slight	Slight	White oak---------- Shortleaf pine------ Northern red oak---- Black oak----------	55 56 --- ---	38 80 --- ---	Shortleaf pine, scarlet oak, white oak, northern red oak, white ash.
2D---------- Goss	3F	Slight	Moderate	Slight	Slight	White oak---------- Shortleaf pine------ Post oak---------- Blackjack oak------- Black oak----------	60 --- --- --- ---	43 --- --- --- ---	Yellow poplar, white ash, white oak, shortleaf pine, northern red oak.
2F---------- Goss	3R	Slight	Moderate	Moderate	Slight	White oak---------- Shortleaf pine------ Post oak---------- Blackjack oak------- Black oak----------	60 --- --- --- ---	43 --- --- --- ---	Yellow poplar, white ash, white oak, shortleaf pine, northern red oak.
3---------- Twomile	4W	Slight	Severe	Moderate	Moderate	Pin oak----------	80	61	Pin oak, eastern cottonwood, pecan, silver maple, green ash, sweetgum.
5B, 5C---------- Hartville	3C	Slight	Slight	Severe	Severe	White oak----------	55	38	Eastern cottonwood, white oak, pin oak.
6B, 6C, 6D------ Bucklick	3A	Slight	Slight	Slight	Slight	White oak---------- Northern red oak---- Black oak---------- Sugar maple--------- Post oak----------	61 --- --- --- ---	44 --- --- --- ---	Yellow poplar, white ash, white oak, eastern white pine, northern red oak.
6E---------- Bucklick	3R	Moderate	Moderate	Slight	Slight	White oak---------- Northern red oak---- Black oak---------- Sugar maple--------- Post oak----------	61 --- --- --- ---	44 --- --- --- ---	Yellow poplar, white ash, white oak, eastern white pine, northern red oak.
6F**: Bucklick-------	3R	Moderate	Moderate	Slight	Slight	White oak---------- Northern red oak---- Black oak---------- Sugar maple--------- Post oak----------	61 --- --- --- ---	3 --- --- --- ---	Yellow poplar, white ash, white oak, eastern white pine, northern red oak.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
6F**: Gatewood	2R	Moderate	Moderate	Slight	Slight	White oak Eastern redcedar Post oak Black oak	45 --- --- ---	30 --- --- ---	Eastern redcedar, shortleaf pine.
7B, 7C2, 7D2---- Menfro	3A	Slight	Slight	Slight	Slight	White oak Northern red oak Black oak White ash Sugar maple	65 75 73 --- ---	48 57 55 --- ---	Shortleaf pine, white ash, black walnut, yellow poplar, white oak, eastern white pine, sugar maple.
7E2, 7F---------- Menfro	3R	Moderate	Moderate	Slight	Slight	White oak Northern red oak Black oak White ash Sugar maple	65 75 73 --- ---	48 57 55 --- ---	Shortleaf pine, white ash, black walnut, yellow poplar, white oak, eastern white pine, sugar maple.
8B, 8C2, 8D2---- Crider	3A	Slight	Slight	Slight	Slight	White oak Northern red oak Shortleaf pine Black oak	66 70 --- ---	48 52 --- ---	Eastern white pine, yellow poplar, black walnut, shortleaf pine, white ash.
8E---------- Crider	3R	Moderate	Moderate	Slight	Slight	White oak Northern red oak Shortleaf pine Black oak	66 70 --- ---	48 52 --- ---	Eastern white pine, yellow poplar, black walnut, shortleaf pine, white ash.
10F**: Gasconade	2R	Slight	Severe	Moderate	Severe	Chinkapin oak Eastern redcedar White ash Sugar maple Mockernut hickory Post oak Blackjack oak	40 30 --- --- --- --- ---	26 --- --- --- --- --- ---	Eastern redcedar.
Rock outcrop.									
12---------- Bremer	7W	Slight	Severe	Moderate	Moderate	Eastern cottonwood Silver maple	90 80	103 34	American sycamore, hackberry, green ash, eastern cottonwood, silver maple.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
13A---------- Auxvasse	4W	Slight	Severe	Moderate	Moderate	Pin oak---------- Northern red oak---- Silver maple-------- Green ash----------	76 --- --- ---	58 --- --- ---	Pin oak, white oak, green ash, eastern cottonwood, silver maple, sweetgum.
14C, 14D-------- Hobson	2D	Slight	Slight	Moderate	Moderate	White oak---------- Black oak---------- Shortleaf pine------	50 55 ---	34 38 ---	Shortleaf pine, white oak, black oak.
15**: Gladden--------	4A	Slight	Slight	Slight	Slight	White oak---------- American sycamore--- Black walnut-------- Shortleaf pine------	75 85 --- ---	57 --- --- ---	Black walnut, shortleaf pine, American sycamore.
Midco----------	3F	Slight	Slight	Moderate	Slight	White oak---------- American sycamore--- Shortleaf pine------ Black oak----------	55 --- --- 60	38 --- --- 43	White oak, shortleaf pine.
16**: Blake----------	12A	Slight	Slight	Slight	Slight	Eastern cottonwood-- Silver maple-------- American sycamore---	115 --- ---	172 --- ---	Eastern cottonwood, silver maple, American sycamore, green ash.
Waldron--------	11C	Slight	Moderate	Severe	Slight	Eastern cottonwood-- Pin oak----------	110 80	156 62	Pin oak, pecan, eastern cottonwood, green ash, silver maple.
17**: Hodge----------	11S	Slight	Slight	Moderate	Slight	Eastern cottonwood-- Silver maple--------	110 105	156 55	Eastern cottonwood, green ash, silver maple.
Blake----------	12A	Slight	Slight	Slight	Slight	Eastern cottonwood-- Silver maple-------- American sycamore---	115 --- ---	172 --- ---	Eastern cottonwood, silver maple, American sycamore, green ash.
19**: Haynie---------	11A	Slight	Slight	Slight	Slight	Eastern cottonwood-- American sycamore--- Black walnut-------- Green ash----------	110 110 --- ---	156 --- --- ---	Black walnut, eastern cottonwood, American sycamore, green ash.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
19**: Waldron	11C	Slight	Moderate	Severe	Slight	Eastern cottonwood Pin oak	110 80	156 62	Pin oak, pecan, eastern cottonwood, green ash, silver maple.
20**: Hodge	11S	Slight	Slight	Moderate	Slight	Eastern cottonwood Silver maple	110 105	156 55	Eastern cottonwood, green ash, silver maple.
Haynie	11A	Slight	Slight	Slight	Slight	Eastern cottonwood American sycamore Black walnut Green ash	110 110 --- ---	156 --- --- ---	Black walnut, eastern cottonwood.
22**: Waldron	11C	Slight	Moderate	Severe	Slight	Eastern cottonwood Pin oak	110 80	156 62	Pin oak, pecan, eastern cottonwood, black willow, green ash, silver maple, sweetgum.
Booker	6W	Slight	Severe	Severe	Severe	Eastern cottonwood Silver maple	85 80	91 34	Eastern cottonwood, pin oak, pecan, green ash, silver maple.
23C2, 23D2 Winfield	3A	Slight	Slight	Slight	Slight	White oak Northern red oak Black oak	65 60 65	48 44 44	Eastern white pine, green ash, yellow poplar, northern red oak, black oak.
24E Gatewood	2R	Moderate	Moderate	Slight	Slight	White oak Eastern redcedar Post oak Black oak	45 --- --- ---	30 --- --- ---	Eastern redcedar, shortleaf pine.
25E Beemont	2C	Slight	Slight	Moderate	Moderate	White oak Eastern redcedar Post oak Black oak	45 --- --- ---	30 --- --- ---	Eastern redcedar, shortleaf pine.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
29F**:									
Menfro	3R	Severe	Severe	Slight	Slight	White oak	65	48	Shortleaf pine, white ash, black walnut, yellow poplar, white oak, eastern white pine, sugar maple.
						Northern red oak	75	57	
						Black oak	73	56	
						White ash	---	---	
						Sugar maple	---	---	
Bardley	2R	Severe	Severe	Slight	Moderate	Post oak	45	30	Shortleaf pine, eastern redcedar, white oak, black oak.
						Chinkapin oak	---	---	
						Black oak	---	---	
						Eastern redcedar	---	---	
36F---------- Bardley	2R	Severe	Severe	Slight	Moderate	Post oak	45	30	Shortleaf pine, eastern redcedar, white oak, black oak.
						Chinkapin oak	---	---	
						Black oak	---	---	
						Eastern redcedar	---	---	
38A**:									
Haymond	5A	Slight	Slight	Slight	Slight	White oak	90	72	Eastern white pine, black walnut, yellow poplar.
						Black walnut	---	---	
Riverwash.									
39---------- Haymond	5A	Slight	Slight	Slight	Slight	White oak	90	72	Eastern white pine, black walnut, yellow poplar.
						Black walnut	---	---	
40A---------- Racoon	4W	Slight	Severe	Moderate	Severe	Pin oak	80	4	Baldcypress, pin oak, water tupelo, red maple.
						Green ash	---	---	
						American sycamore	---	---	
43---------- Cedargap	3F	Slight	Slight	Moderate	Slight	Black oak	66	48	Black oak, shortleaf pine, American sycamore.
44---------- Gladden	4A	Slight	Slight	Slight	Slight	White oak	75	57	Black walnut, shortleaf pine.
						American sycamore	85	---	
						Black walnut	---	---	
						Shortleaf pine	---	---	
45---------- Pope	4A	Slight	Slight	Slight	Slight	White oak	80	62	Eastern white pine, yellow poplar, black walnut, white oak, northern red oak, white ash, shortleaf pine.
						American beech	---	---	
						Blackgum	---	---	
						American sycamore	---	---	
						Northern red oak	---	---	
						American basswood	---	---	
						Eastern hemlock	---	---	
						Bitternut hickory	---	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
46F**:									
Lily	3R	Moderate	Moderate	Slight	Slight	Northern red oak Black oak Post oak White ash White oak	54 58 --- --- ---	38 41 --- --- ---	Shortleaf pine, white ash, northern red oak, white oak.
Holstein	3R	Moderate	Moderate	Moderate	Slight	White oak Northern red oak Black oak	65 75 75	48 57 57	Shortleaf pine, green ash, black walnut, yellow poplar, northern red oak, black cherry, black oak, white oak.
Ramsey	2R	Severe	Severe	Severe	Severe	White oak Shortleaf pine Eastern redcedar	50 50 35	34 68 ---	Eastern redcedar, shortleaf pine.
47D**:									
Lily	3A	Slight	Slight	Slight	Slight	Northern red oak Black oak Post oak White ash White oak	54 58 --- --- ---	38 41 --- --- ---	Shortleaf pine, white ash, northern red oak, white oak.
Hobson	2D	Slight	Slight	Moderate	Moderate	White oak Black oak Shortleaf pine	50 55 ---	34 38 ---	Shortleaf pine, white oak, black oak.
Ramsey	2D	Slight	Slight	Severe	Severe	White oak Shortleaf pine Eastern redcedar	50 --- ---	34 --- ---	Eastern redcedar, shortleaf pine.

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1B2, 1C2, 1D2----- Union	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, Washington hawthorn, Amur privet, eastern redcedar, arrowwood.	Green ash, Osageorange, Austrian pine.	Eastern white pine, pin oak.	---
2D, 2F---------- Goss	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive------	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian olive.	Siberian elm------	---
3---------- Twomile	---	Silky dogwood, Amur honeysuckle, American cranberrybush, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Norway spruce, Austrian pine.	Eastern white pine	Pin oak.
5B, 5C---------- Hartville	Lilac----------	Amur honeysuckle, Amur maple, autumn olive, Manchurian crabapple.	Austrian pine, hackberry, green ash, jack pine, Russian olive, eastern redcedar.	Honeylocust-------	---
6B, 6C, 6D, 6E---- Bucklick	---	Amur honeysuckle, lilac, autumn olive, Amur maple.	Eastern redcedar, Russian olive, hackberry.	Norway spruce, honeylocust, green ash, pin oak, eastern white pine.	---
6F*:					
Bucklick---------	---	Amur honeysuckle, lilac, autumn olive, Amur maple.	Eastern redcedar, Russian olive, hackberry.	Norway spruce, honeylocust, green ash, pin oak, eastern white pine.	---
Gatewood---------	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive------	Russian olive, eastern redcedar, hackberry, bur oak, green ash, Austrian pine.	Honeylocust, Siberian elm.	---
7B, 7C2, 7D2, 7E2, 7F---------- Menfro	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Washington hawthorn, blue spruce, white fir.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

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
8B, 8C2, 8D2, 8E--Crider	---	Lilac, Amur honeysuckle, Amur maple, autumn olive.	Eastern redcedar, hackberry, Russian olive.	Green ash, honeylocust, Norway spruce, eastern white pine, pin oak.	---
10F*: Gasconade. Rock outcrop.					
12--Bremer	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, blue spruce, white fir, northern white-cedar, Washington hawthorn.	Eastern white pine	Pin oak.
13A--Auxvasse	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	Austrian pine, northern white-cedar, white fir, blue spruce, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
14C, 14D--Hobson	Lilac	Amur honeysuckle, Amur maple, Manchurian crabapple, autumn olive.	Hackberry, jack pine, Russian olive, Austrian pine, eastern redcedar, green ash.	Honeylocust	---
15*: Gladden	---	Autumn olive, Amur honeysuckle, Amur maple, lilac.	Eastern redcedar	Austrian pine, honeylocust, pin oak, eastern white pine, hackberry, green ash.	Eastern cottonwood.
Midco	---	Autumn olive, Amur honeysuckle, Amur maple, lilac.	Eastern redcedar	Austrian pine, honeylocust, pin oak, eastern white pine, hackberry, green ash.	Eastern cottonwood.
16*: Blake	---	Tatarian honeysuckle, Siberian peashrub.	Green ash, Osageorange, eastern redcedar, northern white-cedar, white spruce, nannyberry viburnum, Washington hawthorn.	Black willow	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
16*:					
Waldron	---	Siberian peashrub, Tatarian honeysuckle.	Washington hawthorn, nannyberry viburnum, eastern redcedar, white spruce, northern white-cedar, green ash, Osageorange.	Black willow, golden willow.	Eastern cottonwood.
17*:					
Hodge	---	Tatarian honeysuckle, Siberian peashrub.	Osageorange, northern white-cedar, eastern redcedar, nannyberry viburnum, green ash, white spruce, Washington hawthorn.	Black willow, golden willow.	Eastern cottonwood.
Blake	---	Tatarian honeysuckle, Siberian peashrub.	Green ash, Osageorange, eastern redcedar, northern white-cedar, white spruce, nannyberry viburnum, Washington hawthorn.	Black willow	Eastern cottonwood.
19*:					
Haynie	Blackhaw	Tatarian honeysuckle, Siberian peashrub.	Russian olive, Osageorange, eastern redcedar, Washington hawthorn.	Green ash, hackberry, honeylocust, bur oak.	Eastern cottonwood.
Waldron	---	Siberian peashrub, Tatarian honeysuckle.	Washington hawthorn, nannyberry viburnum, eastern redcedar, white spruce, northern white-cedar, green ash, Osageorange.	Black willow, golden willow.	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
20*: Hodge	---	Tatarian honeysuckle, Siberian peashrub.	Osageorange, northern white-cedar, eastern redcedar, nannyberry viburnum, green ash, white spruce, Washington hawthorn.	Black willow, golden willow.	Eastern cottonwood.
Haynie	Blackhaw	Tatarian honeysuckle, Siberian peashrub.	Russian olive, Osageorange, eastern redcedar, Washington hawthorn.	Green ash, hackberry, honeylocust, bur oak.	Eastern cottonwood.
22*: Waldron	---	Siberian peashrub, Tatarian honeysuckle.	Washington hawthorn, nannyberry viburnum, eastern redcedar, white spruce, northern white-cedar, green ash, Osageorange.	Black willow, golden willow.	Eastern cottonwood.
Booker	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
23C2, 23D2 Winfield	---	Amur honeysuckle, Amur privet, silky dogwood, American cranberrybush.	Northern white-cedar, blue spruce, white fir, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
24E Gatewood	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive	Russian olive, eastern redcedar, hackberry, bur oak, green ash, Austrian pine.	Honeylocust, Siberian elm.	---
25E Beemont	Lilac	Amur honeysuckle, Amur maple, autumn olive, Manchurian crabapple.	Russian olive, Austrian pine, eastern redcedar, jack pine, hackberry, green ash.	Honeylocust	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
29F*: Menfro	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Washington hawthorn, blue spruce, white fir.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Bardley	Siberian peashrub	Radiant crabapple, eastern redcedar, Washington hawthorn, autumn olive, lilac, Tatarian honeysuckle, Amur honeysuckle.	Austrian pine, red pine, jack pine, eastern white pine.	---	---
31*: Pits. Udorthents.					
32*. Pits					
36F---------- Bardley	Siberian peashrub	Radiant crabapple, eastern redcedar, Washington hawthorn, autumn olive, lilac, Tatarian honeysuckle, Amur honeysuckle.	Austrian pine, red pine, jack pine, eastern white pine.	---	---
38A*: Haymond	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Riverwash.					
39---------- Haymond	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
40A---------- Racoon	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.

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
43---------- Cedargap	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, northern white-cedar, white fir, Washington hawthorn, blue spruce.	Norway spruce-----	Eastern white pine, pin oak.
44---------- Gladden	---	Autumn olive, Amur honeysuckle, Amur maple, lilac.	Eastern redcedar	Austrian pine, honeylocust, pin oak, eastern white pine, hackberry, green ash.	Eastern cottonwood.
45---------- Pope	---	Lilac, Amur honeysuckle, autumn olive, Amur maple.	Eastern redcedar	Austrian pine, hackberry, green ash, pin oak, eastern white pine, honeylocust.	Eastern cottonwood.
46F*: Lily.					
Holstein---------	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	White fir, Washington hawthorn, northern white-cedar, blue spruce.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Ramsey.					
47D*: Lily.					
Hobson---------- Ramsey.	Lilac----------	Amur honeysuckle, Amur maple, Manchurian crabapple, autumn olive.	Hackberry, jack pine, Russian olive, Austrian pine, eastern redcedar, green ash.	Honeylocust-------	---

* 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
1B2 Union	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, small stones, wetness.	Slight	Moderate: wetness.
1C2 Union	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Slight	Moderate: wetness.
1D2 Union	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope.
2D Goss	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Severe: droughty.
2F Goss	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: droughty, slope.
3 Twomile	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
5B Hartville	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
5C Hartville	Moderate: wetness.	Moderate: wetness.	Severe: slope.	Severe: erodes easily.	Moderate: wetness.
6B Bucklick	Slight	Slight	Moderate: slope.	Slight	Slight.
6C Bucklick	Slight	Slight	Severe: slope.	Slight	Slight.
6D Bucklick	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
6E Bucklick	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
6F*: Bucklick	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gatewood	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
7B Menfro	Slight	Slight	Moderate: slope.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
7C2--- Menfro	Slight	Slight	Severe: slope.	Slight	Slight.
7D2--- Menfro	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
7E2--- Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
7F--- Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
8B--- Crider	Slight	Slight	Moderate: slope.	Slight	Slight.
8C2--- Crider	Slight	Slight	Severe: slope.	Slight	Slight.
8D2--- Crider	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
8E--- Crider	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
10F*: Gasconade---	Severe: slope, thin layer.	Severe: slope, thin layer.	Severe: large stones, slope, thin layer.	Moderate: large stones, slope.	Severe: large stones, slope, thin layer.
Rock outcrop.					
12--- Bremer	Severe: wetness, flooding.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
13A--- Auxvasse	Severe: flooding, wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
14C--- Hobson	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Moderate: wetness.	Moderate: wetness, droughty.
14D--- Hobson	Moderate: wetness, percs slowly, slope.	Moderate: wetness, slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, wetness, droughty.
15*: Gladden---	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Midco---	Severe: flooding, small stones.	Moderate: flooding, small stones.	Severe: small stones, flooding.	Moderate: flooding.	Severe: droughty, 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
16*:					
Blake	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
Waldron	Severe: flooding, wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
17*:					
Hodge	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Blake	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
19*:					
Haynie	Severe: flooding.	Slight	Slight	Slight	Slight.
Waldron	Severe: flooding, wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
20*:					
Hodge	Severe: flooding, too sandy.	Slight	Slight	Slight	Moderate: droughty.
Haynie	Severe: flooding.	Slight	Slight	Slight	Slight.
22*:					
Waldron	Severe: flooding, wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
Booker	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
23C2 Winfield	Slight	Slight	Severe: slope.	Slight	Slight.
23D2 Winfield	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
24E Gatewood	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
25E Beemont	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, small stones, percs slowly.	Slight	Moderate: small stones, slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
29F*:					
Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Bardley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
31*:					
Pits.					
Udorthents.					
32*.					
Pits					
36F	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Bardley					
38A*:					
Haymond	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Riverwash.					
39	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Haymond					
40A	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Racoon					
43	Severe: flooding, small stones.	Severe: small stones.	Severe: small stones, flooding.	Severe: small stones.	Severe: small stones, flooding.
Cedargap					
44	Severe: flooding.	Slight	Moderate: small stones, flooding.	Slight	Moderate: flooding.
Gladden					
45	Slight	Slight	Moderate: small stones.	Slight	Slight.
Pope					
46F*:					
Lily	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Holstein	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Ramsey	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.	Severe: slope, depth to rock.
47D*:					
Lily	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, depth to rock.

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
47D*:					
Hobson	Moderate: wetness, percs slowly, slope.	Moderate: wetness, slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, wetness, droughty.
Ramsey	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight	Severe: depth to rock.

* 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
1B2---------- Union	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
1C2, 1D2---------- Union	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
2D---------- Goss	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
2F---------- Goss	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
3---------- Twomile	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
5B---------- Hartville	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
5C---------- Hartville	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
6B---------- Bucklick	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
6C, 6D---------- Bucklick	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
6E---------- Bucklick	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
6F*:										
Bucklick----------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Gatewood----------	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
7B---------- Menfro	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
7C2, 7D2---------- Menfro	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
7E2---------- Menfro	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
7F---------- Menfro	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
8B---------- Crider	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
8C2, 8D2---------- Crider	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
8E---------- Crider	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
10F*: Gasconade--------- Rock outcrop.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
12---------- Bremer	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
13A---------- Auxvasse	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
14C, 14D---------- Hobson	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
15*: Gladden---------- Midco----------	Good Fair	Good Fair	Good Fair	Good Fair	Good Fair	Poor Very poor.	Very poor. Very poor.	Good Fair	Good Fair	Very poor. Very poor.
16*: Blake---------- Waldron----------	Good Fair	Good Fair	Good Fair	Good Good	Good Good	Good Poor	Good Fair	Good Fair	Good Fair	Good. Poor.
17*: Hodge---------- Blake----------	Poor Good	Fair Good	Fair Good	Fair Good	Fair Good	Very poor. Good	Very poor. Good	Fair Good	Fair Good	Very poor. Good.
19*: Haynie---------- Waldron----------	Good Fair	Good Fair	Good Fair	Good Good	Good Good	Poor Poor	Poor Fair	Good Fair	Good Fair	Poor. Poor.
20*: Hodge---------- Haynie----------	Fair Good	Fair Good	Fair Good	Fair Good	Fair Good	Very poor. Poor	Very poor. Poor	Fair Good	Fair Good	Very poor. Poor.
22*: Waldron---------- Booker----------	Fair Poor	Fair Poor	Fair Fair	Good Poor	Good Poor	Poor Poor	Fair Good	Fair Poor	Fair Poor	Poor. Fair.
23C2, 23D2--------- Winfield	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
24E---------- Gatewood	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
25E---------- Beemont	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	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
29F*:										
Menfro	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Bardley	Very poor.	Very poor.	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
31*:										
Pits.										
Udorthents.										
32*.										
Pits										
36F---- Bardley	Very poor.	Very poor.	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
38A*:										
Haymond	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
Riverwash.										
39---- Haymond	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
40A---- Racoon	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
43---- Cedargap	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
44---- Gladden	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
45---- Pope	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
46F*:										
Lily	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Holstein	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ramsey	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.
47D*:										
Lily	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Hobson	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
Ramsey	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.

* 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
1B2--- Union	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
1C2--- Union	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Moderate: wetness.
1D2--- Union	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: wetness, slope.
2D--- Goss	Moderate: too clayey, large stones, slope.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Severe: droughty.
2F--- Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
3--- Twomile	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.
5B, 5C--- Hartville	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
6B, 6C--- Bucklick	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
6D--- Bucklick	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope.
6E--- Bucklick	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
6F*: Bucklick---	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
Gatewood---	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
7B---------- Menfro	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
7C2---------- Menfro	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
7D2---------- Menfro	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
7E2, 7F---------- Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
8B---------- Crider	Moderate: too clayey.	Slight---------	Slight---------	Slight---------	Severe: low strength, frost action.	Slight.
8C2---------- Crider	Moderate: too clayey.	Slight---------	Slight---------	Moderate: slope.	Severe: low strength, frost action.	Slight.
8D2---------- Crider	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
8E---------- Crider	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
10F*: Gasconade-------- Rock outcrop.	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: large stones, slope, thin layer.
12---------- Bremer	Severe: wetness.	Severe: wetness, shrink-swell, flooding.	Severe: wetness, shrink-swell, flooding.	Severe: wetness, shrink-swell, flooding.	Severe: shrink-swell, low strength.	Moderate: wetness.
13A---------- Auxvasse	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
14C---------- Hobson	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
14D---------- Hobson	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Moderate: wetness, frost action, slope.	Moderate: slope, wetness, droughty.

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
15*:						
Gladden	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Midco	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty, flooding.
16*:						
Blake	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, frost action.	Slight.
Waldron	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
17*:						
Hodge	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Blake	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.	Severe: flooding.
19*:						
Haynie	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
Waldron	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
20*:						
Hodge	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.
Haynie	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
22*:						
Waldron	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
Booker	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.
23C2--- Winfield	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
23D2--- Winfield	Moderate: wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
24E--- Gatewood	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
25E--- Beemont	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: small stones, slope.
29F*:						
Menfro---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
Bardley---	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
31*:						
Pits.						
Udorthents.						
32*.						
Pits						
36F--- Bardley	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
38A*:						
Haymond---	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
Riverwash.						
39--- Haymond	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
40A--- Racoon	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding.
43--- Cedargap	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: small stones, flooding.
44--- Gladden	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: 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
45---------- Pope	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
46F*: Lily----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Holstein---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Ramsey----------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.
47D*: Lily----------	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.	Moderate: slope, depth to rock.
Hobson----------	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Moderate: wetness, frost action, slope.	Moderate: slope, wetness, droughty.
Ramsey----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.

* 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
1B2 Union	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey.
1C2 Union	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey.
1D2 Union	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness, slope.	Poor: too clayey.
2D Goss	Moderate: percs slowly, slope, large stones.	Severe: seepage, slope.	Severe: too clayey, large stones.	Moderate: slope.	Poor: too clayey, small stones.
2F Goss	Severe: slope.	Severe: seepage, slope.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, small stones, slope.
3 Twomile	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
5B Hartville	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
5C Hartville	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
6B Bucklick	Moderate: thin layer, seepage, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Slight	Poor: too clayey.
6C Bucklick	Moderate: thin layer, seepage, percs slowly.	Severe: slope.	Severe: depth to rock, seepage.	Slight	Poor: too clayey.
6D Bucklick	Moderate: thin layer, seepage, percs slowly.	Severe: slope.	Severe: depth to rock, seepage.	Moderate: slope.	Poor: too clayey.
6E Bucklick	Severe: slope.	Severe: slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: too clayey, slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
6F*: Bucklick	Severe: slope.	Severe: slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: too clayey, slope.
Gatewood	Severe: thin layer, seepage, percs slowly.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Severe: slope.	Poor: area reclaim, too clayey, hard to pack.
7B Menfro	Slight	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
7C2 Menfro	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
7D2 Menfro	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
7E2, 7F Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
8B Crider	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: thin layer.
8C2 Crider	Slight	Severe: slope.	Moderate: too clayey.	Slight	Poor: thin layer.
8D2 Crider	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: thin layer.
8E Crider	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope, thin layer.
10F*: Gasconade	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, too clayey, large stones.
Rock outcrop.					
12 Bremer	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
13A Auxvasse	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
14C Hobson	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Fair: wetness, small stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
14D---------- Hobson	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Fair: wetness, slope, small stones.
15*: Gladden----------	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: small stones.
Midco----------	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy, small stones.
16*: Blake----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
Waldron----------	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
17*: Hodge----------	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: too sandy.
Blake----------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
19*: Haynie----------	Moderate: flooding.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
Waldron----------	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
20*: Hodge----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Haynie----------	Moderate: flooding.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
22*: Waldron----------	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Booker----------	Severe: ponding, percs slowly.	Slight----------	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.

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
23C2---------- Winfield	Severe: wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
23D2---------- Winfield	Severe: wetness.	Severe: slope, wetness.	Moderate: slope, wetness.	Moderate: slope, wetness.	Fair: too clayey, slope, wetness.
24E---------- Gatewood	Severe: thin layer, seepage, percs slowly.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Severe: slope.	Poor: area reclaim, too clayey, hard to pack.
25E---------- Beemont	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, seepage.	Moderate: slope.	Poor: too clayey, hard to pack.
29F*: Menfro----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Bardley----------	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: area reclaim, too clayey, hard to pack.
31*: Pits. Udorthents.					
32*. Pits					
36F---------- Bardley	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: area reclaim, too clayey, hard to pack.
38A*: Haymond----------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Riverwash.					
39---------- Haymond	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
40A---------- Racoon	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.
43---------- Cedargap	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: small stones.
44---------- Gladden	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: small stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
45---------- Pope	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
46F*:					
Lily----------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, slope.
Holstein----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Ramsey----------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, slope.
47D*:					
Lily----------	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock.
Hobson----------	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Fair: wetness, slope, small stones.
Ramsey----------	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock.

* 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
1B2, 1C2, 1D2--------- Union	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
2D---------- Goss	Fair: shrink-swell, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
2F---------- Goss	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
3---------- Twomile	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
5B, 5C---------- Hartville	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
6B, 6C, 6D---------- Bucklick	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
6E---------- Bucklick	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
6F*: Bucklick----------	Poor: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Gatewood----------	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
7B, 7C2---------- Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
7D2---------- Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
7E2---------- Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
7F---------- Menfro	Poor: low strength, slope.	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
8B, 8C2---------- Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
8D2---------- Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
8E---------- Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
10F*: Gasconade----------	Poor: area reclaim, large stones, thin layer.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, thin layer.
Rock outcrop.				
12---------- Bremer	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
13A---------- Auxvasse	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
14C, 14D---------- Hobson	Fair: wetness, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
15*: Gladden----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Midco----------	Fair: large stones.	Probable----------	Probable----------	Poor: small stones, area reclaim.
16*: Blake----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Waldron----------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
17*: Hodge----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Blake----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
19*: Haynie----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
19*: Waldron	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
20*: Hodge	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Haynie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
22*: Waldron	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Booker	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
23C2 Winfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
23D2 Winfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
24E Gatewood	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
25E Beemont	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
29F*: Menfro	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Bardley	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
31*: Pits. Udorthents.				
32*. Pits				
36F Bardley	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
38A*: Haymond	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Riverwash.				
39--- Haymond	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
40A--- Racoon	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
43--- Cedargap	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
44--- Gladden	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
45--- Pope	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
46F*: Lily	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Holstein	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Ramsey	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
47D*: Lily	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Hobson	Fair: wetness, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Ramsey	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1B2, 1C2---------- Union	Moderate: seepage, slope.	Moderate: thin layer, wetness.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, rooting depth.
1D2---------- Union	Severe: slope.	Moderate: thin layer, wetness.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
2D, 2F---------- Goss	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
3---------- Twomile	Moderate: seepage.	Moderate: wetness.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
5B, 5C---------- Hartville	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
6B, 6C---------- Bucklick	Moderate: seepage, depth to rock, slope.	Moderate: thin layer.	Deep to water	Slope----------	Favorable------	Favorable.
6D, 6E---------- Bucklick	Severe: slope.	Moderate: thin layer.	Deep to water	Slope----------	Slope----------	Slope.
6F*: Bucklick--------- Gatewood---------	Severe: slope. Severe: slope.	Moderate: thin layer. Severe: hard to pack.	Deep to water Deep to water	Slope---------- Slope, droughty, percs slowly.	Slope---------- Slope, area reclaim.	Slope. Slope, area reclaim.
7B, 7C2---------- Menfro	Moderate: slope, seepage.	Slight---------	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
7D2, 7E2, 7F------ Menfro	Severe: slope.	Slight---------	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
8B, 8C2---------- Crider	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Favorable------	Favorable.
8D2, 8E---------- Crider	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope----------	Slope.
10F*: Gasconade--------	Severe: depth to rock, seepage, slope.	Severe: large stones, thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
10F*: Rock outcrop.						
12---- Bremer	Slight----	Severe: wetness, hard to pack.	Frost action---	Wetness----	Wetness----	Wetness.
13A---- Auxvasse	Slight----	Moderate: wetness.	Percs slowly---	Wetness, percs slowly, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
14C---- Hobson	Moderate: slope.	Moderate: wetness.	Percs slowly, slope.	Slope, wetness, droughty.	Erodes easily, wetness.	Erodes easily, droughty.
14D---- Hobson	Severe: slope.	Moderate: wetness.	Percs slowly, slope.	Slope, wetness, droughty.	Slope, erodes easily, wetness.	Slope, erodes easily, droughty.
15*: Gladden----	Severe: seepage.	Severe: seepage.	Deep to water	Flooding----	Favorable----	Favorable.
Midco----	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, flooding, large stones.	Large stones, too sandy.	Large stones, droughty.
16*: Blake----	Moderate: seepage.	Severe: piping.	Frost action---	Wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
Waldron----	Slight----	Severe: hard to pack, wetness.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
17*: Hodge----	Severe: seepage.	Severe: piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Blake----	Moderate: seepage.	Severe: piping.	Flooding, frost action.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Erodes easily.
19*: Haynie----	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
Waldron----	Slight----	Severe: hard to pack, wetness.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
20*: Hodge----	Severe: seepage.	Severe: piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Haynie----	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
22*: Waldron	Slight	Severe: hard to pack, wetness.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Booker	Slight	Severe: hard to pack, ponding.	Ponding, percs slowly.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
23C2 Winfield	Moderate: seepage, slope.	Moderate: thin layer, wetness.	Frost action, slope.	Slope, erodes easily.	Erodes easily, wetness.	Erodes easily.
23D2 Winfield	Severe: slope.	Moderate: thin layer, wetness.	Frost action, slope.	Slope, erodes easily.	Slope, erodes easily, wetness.	Slope, erodes easily.
24E Gatewood	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, percs slowly.	Slope, area reclaim.	Slope, area reclaim.
25E Beemont	Severe: slope.	Severe: hard to pack.	Deep to water	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
29F*: Menfro	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Bardley	Severe: slope.	Severe: piping, hard to pack.	Deep to water	Slope, thin layer.	Slope, depth to rock, area reclaim.	Slope, depth to rock, area reclaim.
31*: Pits. Udorthents.						
32*. Pits						
36F Bardley	Severe: slope.	Severe: piping, hard to pack.	Deep to water	Slope, droughty, thin layer.	Slope, depth to rock, area reclaim.	Slope, droughty, depth to rock.
38A*: Haymond	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Riverwash.						
39 Haymond	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
40A Racoon	Slight	Severe: thin layer, ponding.	Ponding, percs slowly, flooding.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
43 Cedargap	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, flooding.	Large stones	Large stones.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
44---------- Gladden	Severe: seepage.	Severe: seepage.	Deep to water	Flooding-------	Favorable------	Favorable.
45---------- Pope	Severe: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
46F*:						
Lily----------	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
Holstein---------	Severe: slope.	Moderate: piping.	Deep to water	Slope----------	Slope----------	Slope.
Ramsey----------	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty, depth to rock.
47D*:						
Lily----------	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
Hobson----------	Severe: slope.	Moderate: wetness.	Percs slowly, slope.	Slope, wetness, droughty.	Slope, erodes easily, wetness.	Slope, erodes easily, droughty.
Ramsey----------	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty, depth to rock.

* 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	
1B2, 1C2, 1D2---- Union	0-5	Silt loam--------	CL-ML, CL	A-4, A-6	0-5	85-100	85-100	80-95	60-75	22-35	5-15
	5-30	Silty clay loam, silty clay.	CL	A-6, A-7	0-10	85-95	80-90	75-85	65-75	35-50	15-30
	30-51	Silt loam, cherty silt loam, very cherty silt loam.	CL, SC	A-7, A-6, A-4, A-2	0-20	85-95	40-90	35-85	30-75	25-45	8-22
	51-60	Clay, very cherty clay, cherty silty clay.	CL, CH, SC, GC	A-7	0-20	65-95	50-90	45-65	40-60	45-80	25-45
2D, 2F---------- Goss	0-10	Cherty silt loam	ML, CL, CL-ML	A-4	0-10	65-85	65-75	65-75	65-75	20-30	2-10
	10-21	Very cherty silty clay loam, very cherty silt loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-10
	21-60	Cherty silty clay loam, extremely cherty silty clay, very cherty clay.	GC, SC	A-7, A-2-7	10-45	45-70	20-65	20-50	20-45	50-70	30-40
3---------- Twomile	0-12	Silt loam--------	CL-ML, CL	A-4	0	100	100	95-100	90-100	20-30	4-9
	12-30	Silt loam, silt	CL-ML, CL	A-4	0	100	100	95-100	90-100	20-30	4-9
	30-44	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	90-100	85-95	30-45	15-25
	44-60	Clay loam, silt loam, loam.	CL	A-6	0	100	95-100	90-100	70-90	30-40	10-20
5B, 5C---------- Hartville	0-8	Silt loam--------	ML, CL	A-4, A-6	0-5	95-100	95-100	80-95	70-90	30-40	7-15
	8-17	Silt loam, silty clay loam.	CL	A-6, A-7	0-10	95-100	95-100	90-98	85-95	35-45	20-25
	17-60	Silty clay, clay, silty clay loam.	CH	A-7	0-10	95-100	95-100	90-98	85-95	50-60	30-40
6B, 6C, 6D, 6E--- Bucklick	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-95	25-40	5-15
	6-34	Silty clay loam, silty clay.	CL	A-7	0-10	95-100	85-100	80-100	75-99	40-50	20-30
	34-50	Very cherty silty clay, cherty silty clay, silty clay.	CL, SC, GC	A-7	0-15	70-100	65-100	35-100	35-95	40-50	20-30
	50-54	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
6F*: Bucklick--------	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-95	25-40	5-15
	9-34	Silty clay loam, silty clay.	CL	A-7	0-10	95-100	85-100	80-100	75-99	40-50	20-30
	34-45	Very cherty silty clay, cherty silty clay, silty clay.	CL, SC, GC	A-7	0-15	70-100	65-100	35-100	35-95	40-50	20-30
	45-49	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
6F*:											
Gatewood--------	0-10	Cherty silt loam	CL, SC, GC	A-4, A-6, A-2	5-15	70-90	65-85	40-75	30-70	25-35	7-15
	10-24	Cherty silty clay, cherty clay, clay.	CH	A-7	0-10	80-95	60-90	55-90	50-85	55-75	30-45
	24-28	Very channery clay, channery clay.	CH, SC, GC	A-7	15-30	50-80	45-75	40-70	35-65	55-75	30-45
	28-32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
7B, 7C2, 7D2, 7E2, 7F---------	0-6	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	25-35	11-20
Menfro	6-10	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	90-100	25-40	11-20
	10-54	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
	54-72	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-35	5-15
8B, 8C2, 8D2, 8E-	0-7	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	85-100	25-35	4-12
Crider	7-62	Silt loam, silty clay loam.	CL, ML, CL-ML	A-7, A-6, A-4	0	100	95-100	90-100	85-100	25-42	4-20
10F*:											
Gasconade-------	0-6	Flaggy silty clay loam.	CL	A-6	20-50	75-90	70-85	60-75	55-65	30-40	15-25
	6-15	Flaggy silty clay, flaggy clay, very flaggy silty clay.	GC	A-2-7	20-70	45-55	40-50	30-40	20-35	55-65	35-45
	15-19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
12---------------	0-24	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-60	25-40
Bremer	24-60	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-65	20-35
13A---------------	0-17	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-35	5-15
Auxvasse	17-32	Silty clay, clay	CH	A-7	0	100	100	95-100	90-100	50-65	30-40
	32-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	90-96	35-45	20-25
14C, 14D---------	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	85-100	80-100	70-100	65-100	20-30	5-12
Hobson	8-22	Sandy clay loam, clay loam, silty clay loam.	CL	A-6	0	85-100	80-100	80-100	80-100	30-40	11-20
	22-60	Fine sandy loam, loam, sandy clay loam.	SM-SC, SC	A-4, A-6, A-2-4, A-2-6	0	70-95	60-90	40-65	20-50	20-35	5-15

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	
15*:											
Gladden---------	0-12	Loam----------	ML, CL, CL-ML	A-6, A-4	0	90-100	85-100	70-90	65-80	20-35	5-15
	12-32	Silt loam, loam, cherty loam.	GC, SC, CL, CL-ML	A-4	0-15	50-90	45-80	40-75	35-70	20-30	5-10
	32-60	Very cherty loam, extremely cherty sandy loam, very cherty sandy loam.	GM, GC, SM, SC	A-1, A-2-4	0-20	40-60	20-40	15-25	5-15	<25	NP-10
Midco----------	0-7	Cherty sandy loam	SM, SM-SC, GM, GM-GC	A-2-4, A-1-b	5-20	60-80	45-75	25-45	15-30	<20	NP-7
	7-60	Stratified cherty loam to extremely cherty sand.	GM, GP-GM, GM-GC, SM	A-1, A-2-4	5-30	15-70	10-60	10-50	5-30	<25	NP-5
16*:											
Blake----------	0-8	Silty clay loam	CL	A-7, A-6	0	100	100	90-100	85-95	35-50	15-30
	8-20	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	85-95	30-50	10-30
	20-60	Silt loam, loam, very fine sandy loam.	ML, CL	A-4, A-6	0	100	100	80-90	75-90	30-40	5-15
Waldron---------	0-6	Silty clay-------	CL, CH	A-7	0	100	100	95-100	95-100	45-65	30-45
	6-60	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	100	95-100	90-100	40-65	20-45
17*:											
Hodge----------	0-10	Loamy fine sand	SM	A-2, A-4	0	100	100	90-100	25-45	---	NP
	10-60	Loamy fine sand, fine sand.	SM	A-2, A-4	0	100	100	90-100	25-45	---	NP
Blake----------	0-8	Silty clay loam	CL	A-7, A-6	0	100	100	90-100	85-95	35-50	15-30
	8-20	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	85-95	30-50	10-30
	20-60	Silt loam, loam, very fine sandy loam.	ML, CL	A-4, A-6	0	100	100	80-90	75-90	30-40	5-15
19*:											
Haynie----------	0-8	Very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	85-100	70-100	25-40	5-15
	8-60	Silt loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	85-100	85-100	25-35	5-15
Waldron---------	0-7	Silty clay-------	CL, CH	A-7	0	100	100	95-100	95-100	45-65	30-45
	7-60	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	100	95-100	90-100	40-65	20-45
20*:											
Hodge----------	0-6	Fine sand--------	SM	A-2, A-4	0	100	100	90-100	25-45	---	NP
	6-60	Loamy fine sand, fine sand.	SM	A-2, A-4	0	100	100	90-100	25-45	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
20*:											
Haynie----------	0-8	Very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	85-100	70-100	25-40	5-15
	8-60	Silt loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	85-100	85-100	25-35	5-15
22*:											
Waldron---------	0-9	Silty clay-------	CL, CH	A-7	0	100	100	95-100	95-100	45-65	30-45
	9-60	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	100	95-100	90-100	40-65	20-45
Booker----------	0-14	Silty clay-------	CL, CH	A-7	0	100	100	95-100	95-100	45-75	30-45
	14-60	Clay-------------	CH	A-7	0	100	100	100	95-100	65-85	40-55
23C2, 23D2------- Winfield	0-5	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	25-40	10-20
	5-9	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-45	15-25
	9-48	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
	48-67	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-35	5-15
24E---------- Gatewood	0-9	Cherty silt loam	CL, SC, GC	A-4, A-6, A-2	5-15	70-90	65-85	40-75	30-70	25-35	7-15
	9-24	Cherty silty clay, cherty clay, clay.	CH	A-7	0-10	80-95	60-90	55-90	50-85	55-75	30-45
	24-29	Very channery clay, channery clay, clay.	CH, SC, GC	A-7	0-30	50-95	45-90	40-90	35-85	55-75	30-45
	29-33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
25E---------- Beemont	0-2	Cherty silt loam	GC, CL, SC, ML	A-6, A-4	0-10	60-80	50-75	45-75	40-70	15-35	NP-15
	2-17	Cherty silt loam, cherty loam, very cherty silt loam.	GC, CL, ML, SC	A-6, A-4	0-10	60-80	50-75	45-75	40-70	15-35	NP-15
	17-36	Clay-------------	CH	A-7	0-5	80-100	75-100	70-100	65-95	65-90	45-70
	36-52	Cherty silty clay, cherty clay, clay.	GC, CH, SC, CL	A-7	0-15	60-90	50-80	45-75	40-75	40-65	20-45
	52-56	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
29F*:											
Menfro----------	0-10	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	25-35	11-20
	10-14	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	90-100	25-40	11-20
	14-45	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
	45-60	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-35	5-15
Bardley---------	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0-5	80-95	75-90	65-85	65-80	25-35	5-15
	8-30	Silty clay, clay, cherty clay.	MH, GM, SM	A-7	0-10	70-95	50-95	50-90	40-85	50-70	20-35
	30-34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
31*: Pits.											
Udorthents.											

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
32*. Pits											
36F---------- Bardley	0-7	Cherty silt loam	GC, CL, SC, CL-ML	A-6, A-4	0-15	60-90	50-75	50-70	45-65	25-35	5-15
	7-33	Silty clay, clay, cherty clay.	GM, SM, MH	A-7	0-10	70-95	50-95	50-90	40-85	50-70	20-35
	33-37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
38A*: Haymond---------	0-4	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	4-60	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
Riverwash.											
39---------- Haymond	0-10	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	10-60	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
40A---------- Racoon	0-12	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	20-40	8-20
	12-32	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	20-40	5-20
	32-60	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	15-30
43---------- Cedargap	0-12	Cherty loam------	SM, GM	A-1, A-2-4, A-4	2-15	40-85	30-75	20-60	15-50	25-35	3-9
	12-36	Cherty silt loam, cherty loam, very cherty loam.	SM, GM	A-1, A-2, A-4	2-15	40-85	20-65	15-45	15-40	25-35	3-9
	36-60	Extremely cherty silty clay loam, extremely cherty clay loam, extremely cherty loam.	GC	A-2-6, A-6	5-20	25-50	20-50	15-45	15-40	30-40	15-25
44---------- Gladden	0-12	Loam-------------	ML, CL, CL-ML	A-6, A-4	0	90-100	85-100	70-90	65-80	20-35	5-15
	12-32	Silt loam, loam, cherty loam.	GC, SC, CL, CL-ML	A-4	0-15	50-90	45-80	40-75	35-70	20-30	5-10
	32-60	Very cherty loam, extremely cherty sandy loam, very cherty sandy loam.	GM, GC, SM, SC	A-1, A-2-4	0-20	40-60	20-40	15-25	5-15	<25	NP-10
45---------- Pope	0-12	Loam-------------	ML, CL, SM, CL-ML	A-4	0	85-100	75-100	70-100	45-90	<30	NP-10
	12-60	Fine sandy loam, sandy loam, loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0	95-100	80-100	51-95	25-75	<30	NP-7
46F*: Lily----------	0-7	Loam-------------	SM, SM-SC	A-4, A-2	0-5	90-100	75-100	60-85	30-55	15-25	NP-5
	7-29	Loam, sandy clay loam.	SC, CL, SM-SC	A-4, A-6	0-5	90-100	75-100	75-95	40-75	20-35	5-15
	29-33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
46F*:											
Holstein	0-9	Loam	CL-ML, CL	A-4, A-6	0-10	90-100	80-100	70-90	55-75	20-30	5-15
	9-18	Clay loam, loam	CL	A-4, A-6	0-5	95-100	85-100	75-95	60-80	25-35	8-15
	18-51	Clay loam	CL	A-6	0-5	95-100	85-100	75-95	60-80	30-40	11-20
	51-65	Sandy clay loam, clay loam, loam.	SC, CL	A-4, A-6	0-5	95-100	85-100	75-90	36-55	25-35	8-15
Ramsey	0-6	Loam	SM, CL-ML, ML, SM-SC	A-4, A-2	0-10	85-100	75-95	60-75	30-70	<25	NP-7
	6-16	Loam, sandy loam, fine sandy loam.	SM, CL-ML, ML, SM-SC	A-4, A-2	0-10	85-100	75-95	60-77	30-70	<25	NP-7
	16-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
47D*:											
Lily	0-8	Sandy loam	SM, SM-SC	A-4, A-2	0-5	90-100	75-100	60-85	30-55	15-25	NP-5
	8-28	Loam, sandy clay loam.	SC, CL, SM-SC	A-4, A-6	0-5	90-100	75-100	75-95	40-75	20-35	5-15
	28-32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Hobson	0-7	Loam	CL, CL-ML	A-4, A-6	0	85-100	80-100	70-100	65-100	20-30	5-12
	7-23	Sandy clay loam, clay loam, silty clay loam.	CL	A-6	0	85-100	80-100	80-100	80-100	30-40	11-20
	23-44	Fine sandy loam, loam, sandy clay loam.	SM-SC, SC	A-4, A-6, A-2-4, A-2-6	0	70-95	60-90	40-65	20-50	20-35	5-15
	44-60	Sandy clay loam, clay loam, clay.	CL	A-4, A-6, A-7	0	85-100	70-90	65-90	60-90	25-50	8-25
Ramsey	0-6	Sandy loam	SM, CL-ML, ML, SM-SC	A-4, A-2	0-10	85-100	75-95	60-75	30-70	<25	NP-7
	6-15	Loam, sandy loam, fine sandy loam.	SM, CL-ML, ML, SM-SC	A-4, A-2	0-10	85-100	75-95	60-77	30-70	<25	NP-7
	15-19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

* 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		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
1B2, 1C2, 1D2----	0-5	10-27	1.35-1.45	0.6-2.0	0.13-0.21	5.6-6.5	Moderate-----	0.43	4	7	.5-2
Union	5-30	27-45	1.30-1.40	0.6-2.0	0.13-0.21	4.5-5.5	Moderate-----	0.43			
	30-51	15-35	1.60-1.80	0.06-0.2	0.03-0.05	3.6-5.0	Moderate-----	0.43			
	51-60	40-80	1.30-1.40	0.2-0.6	0.11-0.15	4.5-6.0	High---------	0.43			
2D, 2F----------	0-10	10-27	1.10-1.30	2.0-6.0	0.06-0.17	4.5-6.5	Low----------	0.24	2	8	1-2
Goss	10-21	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low----------	0.10			
	21-60	35-60	1.30-1.50	0.6-2.0	0.04-0.09	4.5-6.0	Moderate-----	0.10			
3----------	0-12	10-18	1.35-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.43	5	6	1-2
Twomile	12-30	10-18	1.40-1.50	0.06-0.6	0.10-0.13	3.6-6.0	Low----------	0.43			
	30-44	25-35	1.30-1.40	0.06-0.2	0.08-0.10	3.6-6.5	Moderate-----	0.43			
	44-60	12-35	1.30-1.50	0.2-0.6	0.12-0.16	4.5-7.3	Moderate-----	0.43			
5B, 5C----------	0-8	20-27	1.10-1.30	0.6-2.0	0.22-0.24	4.5-6.5	Low----------	0.43	3	6	1-3
Hartville	8-17	24-40	1.20-1.40	0.06-0.2	0.18-0.21	4.5-5.5	Moderate-----	0.43			
	17-60	35-60	1.20-1.50	0.06-0.2	0.10-0.12	4.5-6.5	High---------	0.32			
6B, 6C, 6D, 6E---	0-6	15-25	1.35-1.45	0.6-6.0	0.15-0.24	4.5-7.3	Low----------	0.32	4	6	2-4
Bucklick	6-34	35-45	1.25-1.35	0.6-2.0	0.10-0.18	4.5-7.3	High---------	0.32			
	34-50	35-45	1.25-1.55	0.6-2.0	0.08-0.18	5.1-7.3	High---------	0.32			
	50-54	---	---	---	---	---	----------	----			
6F*:											
Bucklick--------	0-9	15-25	1.35-1.45	0.6-6.0	0.15-0.24	4.5-7.3	Low----------	0.32	4	6	2-4
	9-34	35-45	1.25-1.35	0.6-2.0	0.10-0.18	4.5-7.3	High---------	0.32			
	34-45	35-45	1.25-1.55	0.6-2.0	0.08-0.18	6.1-7.3	High---------	0.32			
	45-49	---	---	---	---	---	----------	----			
Gatewood--------	0-10	15-25	1.10-1.40	0.6-2.0	0.12-0.17	5.1-6.5	Low----------	0.32	2	8	.5-2
	10-24	60-85	1.10-1.30	0.06-0.2	0.09-0.12	5.1-6.0	High---------	0.32			
	24-28	60-85	1.10-1.30	0.06-0.2	0.07-0.10	6.1-7.8	High---------	0.32			
	28-32	---	---	---	---	---	----------	----			
7B, 7C2, 7D2,											
7E2, 7F---------	0-6	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	.5-2
Menfro	6-10	25-30	1.30-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.37			
	10-54	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	54-72	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
8B, 8C2, 8D2, 8E-	0-7	15-27	1.20-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Low----------	0.32	5	6	2-4
Crider	7-62	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.1-7.3	Low----------	0.28			
10F*:											
Gasconade-------	0-6	35-50	1.35-1.50	0.6-2.0	0.10-0.12	6.1-7.8	Moderate-----	0.20	2	8	2-4
	6-15	35-60	1.45-1.70	0.2-0.6	0.05-0.07	6.1-7.8	Moderate-----	0.20			
	15-19	---	---	---	---	---	----------	----			
Rock outcrop.											
12----------	0-24	25-32	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7	4-7
Bremer	24-60	35-42	1.30-1.40	0.2-0.6	0.15-0.17	5.6-6.5	High---------	0.28			
13A----------	0-17	8-16	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.43	3	6	.5-1
Auxvasse	17-32	45-60	1.35-1.50	<0.06	0.09-0.11	4.5-5.5	High---------	0.43			
	32-60	25-40	1.35-1.50	0.2-0.6	0.18-0.20	4.5-5.5	Moderate-----	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		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
14C, 14D---------	0-8	15-25	1.20-1.50	0.6-2.0	0.22-0.24	4.5-6.0	Low----------	0.37	3	6	.5-2
Hobson	8-22	25-35	1.30-1.50	0.6-2.0	0.12-0.17	4.5-5.5	Low----------	0.37			
	22-60	15-30	1.60-1.80	0.06-0.2	0.01-0.05	4.5-5.5	Low----------	0.37			
15*:											
Gladden---------	0-12	10-27	1.25-1.45	0.6-2.0	0.20-0.22	4.5-6.0	Low----------	0.32	4	5	2-4
	12-32	10-18	1.30-1.50	0.6-2.0	0.10-0.15	4.5-5.5	Low----------	0.32			
	32-60	5-18	1.30-1.55	>6.0	0.01-0.03	4.5-5.5	Low----------	0.24			
Midco-----------	0-7	10-20	1.10-1.30	2.0-6.0	0.07-0.11	5.6-6.5	Low----------	0.24	4	8	.5-2
	7-60	5-25	1.10-1.30	2.0-6.0	0.02-0.06	5.1-7.3	Low----------	0.24			
16*:											
Blake-----------	0-8	27-35	1.25-1.30	0.6-2.0	0.20-0.22	6.6-8.4	Moderate-----	0.37	5	4L	1-3
	8-20	22-35	1.25-1.30	0.6-2.0	0.20-0.22	7.4-8.4	Moderate-----	0.37			
	20-60	10-20	1.30-1.35	0.6-2.0	0.20-0.22	7.4-8.4	Low----------	0.37			
Waldron---------	0-6	40-50	1.35-1.45	0.06-0.2	0.12-0.14	6.6-7.8	High---------	0.32	5	4	2-4
	6-60	35-50	1.45-1.60	0.06-0.2	0.10-0.18	7.4-8.4	High---------	0.32			
17*:											
Hodge-----------	0-10	5-15	1.40-1.50	6.0-20	0.07-0.12	6.6-7.8	Low----------	0.17	5	2	.5-1
	10-60	5-12	1.40-1.55	6.0-20	0.06-0.10	6.6-7.8	Low----------	0.17			
Blake-----------	0-8	27-35	1.25-1.30	0.6-2.0	0.20-0.22	7.4-8.4	Moderate-----	0.37	5	4L	1-3
	8-20	22-35	1.25-1.30	0.6-2.0	0.20-0.22	7.4-8.4	Moderate-----	0.37			
	20-60	10-20	1.30-1.35	0.6-2.0	0.20-0.22	7.4-8.4	Low----------	0.37			
19*:											
Haynie----------	0-8	15-25	1.20-1.35	0.6-2.0	0.18-0.23	6.6-8.4	Low----------	0.37	5	4L	1-3
	8-60	15-18	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low----------	0.37			
Waldron---------	0-7	40-50	1.35-1.45	0.06-0.2	0.12-0.14	6.6-7.8	High---------	0.32	5	4	2-4
	7-60	35-50	1.45-1.60	0.06-0.2	0.10-0.18	7.4-8.4	High---------	0.32			
20*:											
Hodge-----------	0-6	5-15	1.40-1.50	6.0-20	0.07-0.12	6.6-7.8	Low----------	0.17	5	2	.5-1
	6-60	5-12	1.40-1.55	6.0-20	0.06-0.10	6.6-7.8	Low----------	0.17			
Haynie----------	0-8	15-25	1.20-1.35	0.6-2.0	0.18-0.23	6.6-8.4	Low----------	0.37	5	4L	1-3
	8-60	15-18	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low----------	0.37			
22*:											
Waldron---------	0-9	40-50	1.35-1.45	0.06-0.2	0.12-0.14	6.6-7.8	High---------	0.32	5	4	2-4
	9-60	35-50	1.45-1.60	0.06-0.2	0.10-0.18	7.4-8.4	High---------	0.32			
Booker----------	0-14	40-70	1.30-1.50	<0.06	0.12-0.14	5.6-7.3	Very high----	0.28	5	4	1-3
	14-60	60-75	1.30-1.50	<0.06	0.09-0.11	5.6-7.3	Very high----	0.28			
23C2, 23D2-------	0-5	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	6	.5-2
Winfield	5-9	25-30	1.30-1.50	0.6-2.0	0.18-0.22	5.6-7.3	Moderate-----	0.37			
	9-48	27-35	1.30-1.50	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37			
	48-67	20-27	1.30-1.50	0.6-2.0	0.20-0.22	5.1-6.0	Low----------	0.37			
24E---------------	0-9	15-25	1.10-1.40	0.6-2.0	0.12-0.17	5.1-6.5	Low----------	0.32	2	8	.5-2
Gatewood	9-24	60-85	1.10-1.30	0.06-0.2	0.09-0.12	5.1-6.0	High---------	0.32			
	24-29	60-85	1.10-1.30	0.06-0.2	0.07-0.10	6.1-7.8	High---------	0.32			
	29-33	---	---	---	---	---	----------	----			

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		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
25E----------	0-2	10-27	1.30-1.40	2.0-6.0	0.14-0.17	4.5-6.5	Low----------	0.32	3	8	1-2
Beemont	2-17	10-27	1.30-1.45	2.0-6.0	0.14-0.17	3.6-6.0	Low----------	0.32			
	17-36	60-85	1.35-1.50	<0.06	0.09-0.12	4.5-5.5	High---------	0.32			
	36-52	35-60	1.40-1.55	<0.06	0.09-0.15	4.5-5.5	High---------	0.32			
	52-56	---	---	---	---	---	----------	----			
29F*:											
Menfro----------	0-10	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	.5-2
	10-14	25-30	1.30-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.37			
	14-45	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	45-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
Bardley---------	0-8	18-27	1.40-1.55	0.6-2.0	0.18-0.22	4.5-6.5	Low----------	0.32	3	6	.5-2
	8-30	60-85	1.20-1.40	0.6-2.0	0.08-0.12	4.5-6.5	Moderate-----	0.32			
	30-34	---	---	---	---	---	----------	----			
31*:											
Pits.											
Udorthents.											
32*.											
Pits											
36F----------	0-7	18-27	1.40-1.55	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.28	3	8	.5-2
Bardley	7-33	50-85	1.20-1.40	0.6-2.0	0.08-0.12	4.5-6.5	Moderate-----	0.28			
	33-37	---	---	---	---	---	----------	----			
38A*:											
Haymond---------	0-4	10-18	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	5	1-3
	4-60	10-18	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
Riverwash.											
39----------	0-10	10-18	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	5	1-3
Haymond	10-60	10-18	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
40A----------	0-12	20-27	1.30-1.50	0.2-0.6	0.22-0.24	4.5-7.3	Moderate-----	0.43	3	6	1-2
Racoon	12-32	18-25	1.35-1.50	0.2-0.6	0.20-0.22	4.5-7.3	Moderate-----	0.43			
	32-60	27-35	1.35-1.60	0.06-0.2	0.18-0.20	4.5-5.5	High---------	0.43			
43----------	0-12	12-25	1.20-1.45	2.0-6.0	0.11-0.18	5.6-7.3	Low----------	0.24	5	8	1-4
Cedargap	12-36	12-27	1.30-1.50	2.0-6.0	0.10-0.15	5.6-7.3	Low----------	0.24			
	36-60	25-35	1.40-1.55	2.0-6.0	0.04-0.10	5.6-7.3	Low----------	0.10			
44----------	0-12	10-27	1.25-1.45	0.6-2.0	0.20-0.22	4.5-6.0	Low----------	0.32	4	5	2-4
Gladden	12-32	10-18	1.30-1.50	0.6-2.0	0.10-0.15	4.5-5.5	Low----------	0.32			
	32-60	5-18	1.30-1.55	2.0-6.0	0.01-0.03	4.5-5.5	Low----------	0.24			
45----------	0-12	5-15	1.20-1.40	0.6-2.0	0.14-0.23	3.6-6.5	Low----------	0.37	5	5	1-4
Pope	12-60	5-18	1.30-1.60	0.6-2.0	0.10-0.18	3.6-5.5	Low----------	0.28			
46F*:											
Lily----------	0-7	5-18	1.20-1.40	2.0-6.0	0.13-0.18	3.6-5.5	Low----------	0.28	3	5	.5-2
	7-29	18-35	1.20-1.40	2.0-6.0	0.12-0.18	3.6-5.5	Low----------	0.28			
	29-33	---	---	---	---	---	----------	----			
Holstein--------	0-9	12-27	1.20-1.45	0.6-2.0	0.20-0.22	5.6-6.5	Low----------	0.32	5	6	.5-2
	9-18	18-30	1.35-1.50	0.6-2.0	0.17-0.19	5.1-6.0	Low----------	0.32			
	18-51	27-35	1.40-1.55	0.6-2.0	0.15-0.17	4.5-6.0	Moderate-----	0.32			
	51-65	22-35	1.45-1.65	0.6-2.0	0.15-0.17	4.5-6.0	Low----------	0.32			

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		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
46F*:											
Ramsey	0-6	8-25	1.25-1.50	6.0-20	0.09-0.12	4.5-5.5	Low	0.24	1	5	.5-2
	6-16	8-25	1.20-1.40	6.0-20	0.09-0.12	4.5-5.5	Low	0.17			
	16-20	---	---	---	---	---	---	---			
47D*:											
Lily	0-8	5-18	1.20-1.40	2.0-6.0	0.13-0.18	3.6-5.5	Low	0.28	3	5	.5-2
	8-28	18-35	1.20-1.40	2.0-6.0	0.12-0.18	3.6-5.5	Low	0.28			
	28-32	---	---	---	---	---	---	---			
Hobson	0-7	15-25	1.20-1.50	0.6-2.0	0.22-0.24	4.5-6.0	Low	0.37	3	6	.5-2
	7-23	25-35	1.30-1.50	0.6-2.0	0.12-0.17	4.5-5.5	Low	0.37			
	23-44	15-30	1.60-1.80	0.06-0.2	0.01-0.05	4.5-5.5	Low	0.37			
	44-60	20-45	1.30-1.60	0.2-0.6	0.01-0.05	4.5-5.5	Low	0.37			
Ramsey	0-6	8-20	1.25-1.50	6.0-20	0.09-0.12	4.5-5.5	Low	0.24	1	3	.5-2
	6-15	8-25	1.20-1.40	6.0-20	0.09-0.12	4.5-5.5	Low	0.17			
	15-19	---	---	---	---	---	---	---			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1B2, 1C2, 1D2----- Union	C	None--------	---	---	1.5-3.0	Perched	Dec-Mar	>60	---	Moderate	High-----	High.
2D, 2F---------- Goss	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
3---------- Twomile	C/D	Rare--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	High-----	High-----	High.
5B, 5C---------- Hartville	C	None--------	---	---	1.5-3.0	Perched	Nov-May	>60	---	High-----	Moderate	Moderate.
6B, 6C, 6D, 6E---- Bucklick	C	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	Moderate	Moderate.
6F*:												
Bucklick---------	C	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	Moderate	Moderate.
Gatewood---------	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Moderate.
7B, 7C2, 7D2, 7E2, 7F---------- Menfro	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.
8B, 8C2, 8D2, 8E-- Crider	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
10F*:												
Gasconade--------	D	None--------	---	---	>6.0	---	---	4-20	Hard	Moderate	High-----	Low.
Rock outcrop.												
12---------- Bremer	C	Rare--------	---	---	1.0-2.0	Apparent	Nov-May	>60	---	High-----	Moderate	Moderate.
13A---------- Auxvasse	D	Rare--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	Moderate	High-----	High.
14C, 14D---------- Hobson	C	None--------	---	---	1.5-3.0	Perched	Dec-Mar	>60	---	Moderate	Moderate	High.
15*:												
Gladden----------	B	Frequent----	Very brief to brief.	Nov-May	>6.0	---	---	>60	---	Moderate	High-----	High.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
15*:												
Midco	A	Frequent	Very brief	Nov-May	>6.0	---	---	>60	---	Moderate	Low	Moderate.
16*:												
Blake	B	Rare	---	---	2.0-4.0	Apparent	Nov-May	>60	---	High	High	Low.
Waldron	D	Rare	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High	High	Low.
17*:												
Hodge	A	Frequent	Brief to long.	Nov-May	>6.0	---	---	>60	---	Low	Low	Low.
Blake	B	Frequent	Very brief to long.	Nov-May	2.0-4.0	Apparent	Nov-May	>60	---	High	High	Low.
19*:												
Haynie	B	Rare	---	---	>6.0	---	---	>60	---	High	Low	Low.
Waldron	D	Rare	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High	High	Low.
20*:												
Hodge	A	Rare	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Haynie	B	Rare	---	---	>6.0	---	---	>60	---	High	Low	Low.
22*:												
Waldron	D	Rare	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High	High	Low.
Booker	D	Rare	---	---	+.5-1.0	Apparent	Nov-May	>60	---	Moderate	High	Moderate.
23C2, 23D2--- Winfield	B	None	---	---	2.5-4.0	Perched	Nov-Apr	>60	---	High	Moderate	Moderate.
24E--- Gatewood	C	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High	Moderate.
25E--- Beemont	C	None	---	---	4.0-6.0	Perched	Nov-Apr	40-60	Hard	Moderate	High	High.
29F*:												
Menfro	B	None	---	---	>6.0	---	---	>60	---	High	Low	Moderate.
Bardley	C	None	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
31*:												
Pits.												
Udorthents.												

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
32*. Pits												
36F---------- Bardley	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
38A*: Haymond----------	B	Frequent----	Brief-----	Nov-May	>6.0	---	---	>60	---	High-----	Low------	Low.
Riverwash.												
39---------- Haymond	B	Occasional	Brief-----	Nov-May	>6.0	---	---	>60	---	High-----	Low------	Low.
40A---------- Racoon	C/D	Occasional	Brief-----	Nov-May	+.5-1.0	Apparent	Nov-May	>60	---	High-----	High-----	High.
43---------- Cedargap	B	Frequent----	Very brief	Nov-May	>6.0	---	---	>60	---	Moderate	Low------	Low.
44---------- Gladden	B	Occasional	Very brief to brief.	Nov-May	>6.0	---	---	>60	---	Moderate	High-----	High.
45---------- Pope	B	Occasional	Very brief to brief.	Nov-May	>6.0	---	---	>60	---	Moderate	Low------	High.
46F*: Lily----------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	High.
Holstein----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Ramsey----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	---	Low------	Moderate.
47D*: Lily----------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	High.
Hobson----------	C	None--------	---	---	1.5-3.0	Perched	Dec-Mar	>60	---	Moderate	Moderate	High.
Ramsey----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	---	Low------	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Auxvasse	Fine, montmorillonitic, mesic Aeric Albaqualfs
Bardley	Very fine, mixed, mesic Typic Hapludalfs
Beemont	Very fine, montmorillonitic, mesic Typic Hapludalfs
Blake	Fine-silty, mixed (calcareous), mesic Aquic Udifluvents
Booker	Very fine, montmorillonitic, mesic Vertic Haplaquolls
Bremer	Fine, montmorillonitic, mesic Typic Argiaquolls
Bucklick	Fine, mixed, mesic Typic Hapludalfs
Cedargap	Loamy-skeletal, mixed, mesic Cumulic Hapludolls
Crider	Fine-silty, mixed, mesic Typic Paleudalfs
Gasconade	Clayey-skeletal, mixed, mesic Lithic Hapludolls
Gatewood	Very fine, mixed, mesic Typic Hapludalfs
Gladden	Coarse-loamy, siliceous, mesic Fluventic Dystrochrepts
Goss	Clayey-skeletal, mixed, mesic Typic Paleudalfs
Hartville	Fine, mixed, mesic Aquic Hapludalfs
Haymond	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Haynie	Coarse-silty, mixed (calcareous), mesic Mollic Udifluvents
Hobson	Fine-loamy, siliceous, mesic Typic Fragiudalfs
Hodge	Mixed, mesic Typic Udipsamments
Holstein	Fine-loamy, mixed, mesic Typic Paleudalfs
Lily	Fine-loamy, siliceous, mesic Typic Hapludults
Menfro	Fine-silty, mixed, mesic Typic Hapludalfs
Midco	Loamy-skeletal, siliceous, nonacid, mesic Typic Udifluvents
Pope	Coarse-loamy, mixed, mesic Fluventic Dystrochrepts
Racoon	Fine-silty, mixed, mesic Typic Ochraqualfs
Ramsey	Loamy, siliceous, mesic Lithic Dystrochrepts
Twomile	Fine-silty, mixed, mesic Typic Albaqualfs
Udorthents	Loamy, mixed, mesic Udorthents
Union	Fine, mixed, mesic Typic Fragiudalfs
Waldron	Fine, montmorillonitic (calcareous), mesic Aeric Fluvaquents
Winfield	Fine-silty, mixed, mesic Typic Hapludalfs

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